

# Indian Council of Medical Research – Neurocognitive Toolbox (ICMR-NCTB) Manual



By

ICMR-NCTB Consortium



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<b>Contents</b>	<b>Page</b>
<b>1. Introduction</b>	6
<b>2. Background for development of the ICMR-NCTB</b>	6
<b>3. Development and standardisation of the ICMR-NCTB</b>	7
<b>4. General Testing Considerations</b>	
4.1 Physical condition	8
4.2 Establishing and maintaining rapport	8
4.3 Instructions	9
4.4 Testing examinees with physical or language impairments	9
4.5 Application of the ICMR-NCTB	9
<b>5. Description of the tests in the ICMR-NCTB</b>	
5.1 Montreal Cognitive Assessment	11
5.2 Trail Making Test Black & White (A & B)	11
5.3 Category Fluency Test	11
5.4 Phonemic Fluency Test	12
5.5 Verbal Learning Test	12
5.6 TNI-93	12
5.7 Picture Naming Test (PNT)	13
5.8 Frenchay Aphasia Screening Test (FAST)	13
5.9 Modified Taylor Complex Figure Test (MTCF)	13
5.10 Line Bisection Test	14
<b>6. Testing procedure, instructions for administering the tests &amp; scoring procedure</b>	
6.1 Montreal Cognitive Assessment	15
6.2 Trail Making Test Black & White (A & B)	21
6.3 Category Fluency Test	22
6.4 Phonemic Fluency Test	24
6.5 Verbal Learning Test	25
6.6 TNI-93	26
6.7 Picture Naming Test (PNT)	28
6.8 Frenchay Aphasia Screening Test (FAST)	30

6.9 Modified Taylor Complex Figure Test (MTCF)	32
6.10 Line Bisection Test	34
<b>7. Collection of data: Healthy participants &amp; patients</b>	
7.1 Procedure	35
7.2 Demographic characteristics of the healthy participants across centres	35
7.3 Demographic characteristics of the patients across centres	44
<b>8. Psychometric properties of the ICMR-NCTB</b>	
8.1 Performance of healthy participants on the ICMR-NCTB	46
8.2 Correlations between demographic variables and test scores	46
<b>9. Summary</b>	
9.1 Limitations of the battery	53
9.2 Range of application	53
9.3 Test score interpretation	54
<b>10. References</b>	55

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## ABBREVIATIONS

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LMIC	Lower Middle Income Countries
ACE-III	Addenbrooke's Cognitive Examination-III
CDR	Clinical Dementia Rating
RAVLT	Rey Auditory Verbal Learning Test
CTT	Color Trails Test
HADS	Hospital Anxiety and Depression Scale
MoCA	Montreal Cognitive Assessment
TMT	Trail Making Test
VLT	Verbal Learning Test
TNI	Test des Neuf Images du 93
MTCF	Modified Taylor Complex Figure
FAST	Frenchay Aphasia Screening Test
PNT	Picture Naming Test
MCI	Mild Cognitive Impairment
AD	Alzheimer's Disease
FTD	Fronto-Temporal Dementia
VaD	Vascular Dementia
SES	Socio Economic Status

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## **1. Introduction**

The Indian Council of Medical Research – Neurocognitive Tool Box (ICMR-NCTB) was developed to meet demands for a standardized set of cognitive tests that is culturally appropriate and available in different languages for our country. The ICMR-NCTB is made available for clinical and research purposes to diagnose dementia. It is individually administered and is designed for use with individuals aged 40 to 80 years with at least 1 year of education. The ICMR-NCTB has been standardized across 5 languages (Hindi, Bengali, Telugu, Kannada, and Malayalam). It yields scores across various cognitive domains including attention and executive function, episodic memory, language, visuospatial ability, unilateral spatial neglect, and questionnaires. The administration of the entire battery would take approximately 90 minutes.

## **2. Background for development of the ICMR-NCTB**

As we trend towards an ageing population there is an unprecedented and rapidly increasing number of people with dementia, especially in low and middle-income countries (LMICs). One of the main barriers to studying dementia in LMICs is the low rate of diagnosis (Alzheimer's & Related Disorders Society of India, 2010). Early diagnosis is crucial for treatment intervention and strategies to delay progression. Lack of awareness about dementia, limited availability of appropriate diagnostic tools and scarcity of skilled professionals specialized in dementia diagnosis contribute to this barrier to diagnosis in LMICs. Diagnosis of dementia and its preclinical stage of Mild Cognitive Impairment (MCI) rely on the availability of neuropsychological tests, behavioral and functional measures that are culturally appropriate and validated for local populations. However, there are several challenges in the use of neuropsychological tests for diagnosis of cognitive impairment in developing countries like India: firstly, most tests have been developed for educated, predominantly English-speaking Western populations and are not suitable for use in other languages and cultures (Ardila, 1995). Secondly, widely variant education levels remain prevalent in developing countries and complicates the adaptation of diagnostic tests.

There are 122 major languages and 1599 other languages spoken in India. The 2011 census recorded Hindi as the mostly widely spoken language with 57.1% of the Indian population speaking Hindi; 10.6% speaking English, followed by Bengali (8.9%) and Telugu (7.8%), and 4.9% and 2.9% speaking Kannada and Malayalam languages respectively (Census of India, 2011). These socio-demographic and cultural differences need to be accounted for while testing cognition in diverse populations. This will require culturally, educationally and linguistically appropriate

neuropsychological tests. Achieving this is a complex process and will entail different approaches such as, translating existing standardized cognitive tests, adapting tests for cultural relevance or developing innovative tests indigenously.

Majority of the ICMR-NCTB tests are derived from review of existing batteries used in different settings: 10/66 Dementia Research Group cognitive test battery, Vascular cognitive impairment (VCI) harmonization standards of National Institute of Neurological Disorders and Stroke and Association Internationale pour la Recherche et l'Enseignement en Neurosciences (NINDS-AIREN) and Canadian Stroke Network (CSN) (Hachinski et al., 2006) and CERAD (Consortium to Establish a Registry for Alzheimer's Disease). These cognitive test batteries proposed a common methodology of using standardised and validated cognitive, behavioural and functional assessments, to diagnose cognitive impairment and dementia across different populations. We also reviewed neuropsychological test batteries that were validated for Indian languages: Indo US Cognitive and Functional Screening Instruments, NIMHANS Neuropsychological Battery, Kolkata Cognitive Screening battery and PGI Battery of Brain Dysfunction. The ICMR NCTB has been adapted and validated for diagnosis of dementia (Alzheimer's disease and Vascular dementia, Mild Cognitive Impairment and Vascular Cognitive Impairment) in Hindi, Bengali, Telugu, Kannada, and Malayalam. Age and education matched cut off scores were not derived as the sample sizes were too small and the statistical analyses did not determine a significant effect of age and education. Testing in other languages would also have to be done with caution as tests can be influenced by language and ad hoc translation of tests may alter critical functions of the test.

### **3. Developments and Standardisation of the ICMR-NCTB**

The goal of the project was to develop a comprehensive cognitive, behavioural and functional test battery for diagnosing MCI and dementia in five different Indian languages: Hindi, Bengali, Telugu, Kannada and Malayalam.

The ICMR-NCTB is a product of a multicentric study supported by the Indian Council of Medical Research (ICMR). Six centres across India collaborated - Hyderabad, Delhi, Kolkata, Trivandrum, Bangalore and Belgaum. A multidisciplinary group of neurologists, neuropsychologists, speech and language pathologists and experts from related fields worked together. The collaborating institutions included All Indian Institute of Medical Sciences (AIIMS) New Delhi from the North; Apollo Gleneagles Kolkata from the East; Nizam's Institute of Medical Sciences (NIMS) Hyderabad, National Institute of Mental Health and Neurosciences (NIMHANS) Bangalore, Manipal

Hospital Bangalore, Jawaharlal Nehru Medical College, Belgaum, and Sri Chitra Tirunal Institute of Medical Sciences and Technology (SCTIMST), Trivandrum from three different states in Southern India. The main languages spoken in these areas include: Hindi in Delhi, Bengali in Kolkata, Hindi and Telugu in Hyderabad, Kannada in Bangalore and Belgaum, and Malayalam in Trivandrum.

## **4. General Testing Considerations**

### **4.1 Physical conditions**

The physical setting can affect the examinee's performance. Potential distractions or interruptions should be minimised. The testing room should be well lit, quiet and at a comfortable temperature. Ideally, no one other than the examiner and examinee should be in the room. However, this may not always be practical. In many situations, particularly older people prefer to have their spouse or child in the room. Individuals may be anxious about the testing session, hence having someone familiar in the room may help reduce their anxiety. In such scenarios the family member is instructed to sit behind the examinee and is instructed not to intervene for the whole session. Ideally the examiner should sit opposite the examinee to see the responses clearly and administer the tests with ease.

In many conditions an ideal setting (e.g., quiet space, temperature, privacy, lighting, etc.) may not be available. It is the examiner's responsibility to give the best possible testing condition. In situations with limited facilities, it is important to note that these factors could have contributed/interfered with the examinee's performance.

### **4.2 Establishing and Maintaining Rapport**

A comfortable relationship between the examiner and examinee is essential for a valid assessment. An accepting, nonthreatening tone will promote rapport. Thorough knowledge of tests, instructions and practice of the test will facilitate good rapport and administering tests smoothly. Limiting social interaction with the examinee can help reduce any interruptions with the test.

Administration of tests should be carried out in an unhurried and professional manner. It is important to move from one test to another without demoralising the examinee. Test results are usually not shared with examinee while testing is in progress, this can sometimes lead to increased anxiety. However, encouragement and praise, without giving feedback about performance can help maintain interest in the testing session.

Observing the examinee while testing can add great value to the evaluation. Look out for

signs of low mood, fatigue, boredom, and anxiety as these can interfere with test performance.

### **4.3 Instructions**

The examiners may sometimes need to rephrase the instructions for individuals who find it difficult to understand standard instructions. However, careful consideration must be taken so that it does not interfere with the standard administration procedure as this can influence test performance. For instance on the Trail Making Test Black & White, an individual should not be given more demonstration than the practice items as it could affect test performance.

### **4.4 Testing Examinees with Physical or Language Impairments**

People with physical disability are referred for a cognitive assessment frequently. The impairment at times can impact performance on specific tasks. For instance, a right-handed person with a right hemiparesis may not be able to carry out tests requiring drawing, writing or use of the right arm. Another example would be someone with a hearing impairment, their poor performance on auditory tests would be influenced by their hearing ability, hence focusing more on the visual and non-verbal tests may be better to understand their cognitive functioning. Sometimes it may be required to modify the testing conditions (e.g. giving written instructions or a sign language translation). The clinical judgment of the clinician is crucial in evaluating the impact of the test modification on the performance on that specific cognitive test.

### **4.5 Applications of the Battery**

The ICMR-NCTB is designed to provide relevant information for general clinical and neuropsychological evaluations. The battery may also be used for research purpose. As a clinical assessment tool, the ICMR-NCTB will provide measures of multiple cognitive functions including memory, visuospatial ability, language and executive functions. The battery will be useful for early identification of MCI and dementia. The battery may also be valuable for research. The administration of the battery would require appropriate skill and experience. The battery can be administered by clinicians and researchers under the supervision of a trained psychologist.

## 5. Description of the tests in the ICMR-NCTB

Table-1: ICMR-NCTB Battery

Domain	Function	ICMR-NCTB Tests
<b>Global Cognitive Function</b>	Cognitive Screening Instrument	Montreal Cognitive Assessment (MoCA)
<b>Attention and Executive Function</b>	Visuo-spatial attention & Set Shifting	Trail Making Test B & W (A & B)
	Verbal Fluency Test	Category Fluency – Animal, Food, Vegetable Phonemic Fluency – Ka, Ma, Pa
<b>Episodic Memory</b>	Verbal Memory	Verbal Learning Test (Total Learning, Learning Over Trials, Delayed Recall, & Delayed Recognition)
	Visuo-Spatial Memory	Modified Taylor Complex Figure Test (MTCF) – Immediate and Delayed Recall TNI-93
<b>Language</b>	Word Finding Ability	Picture Naming Test (PNT)
	Language Screening tool for Aphasia	Frenchay Aphasia Screening Test (FAST)
<b>Visuospatial Functions</b>	Visuo-Spatial Organization	Modified Taylor Complex Figure Test (MTCF) - Copy
	Visuo-Spatial Neglect	Line Bisection Test
<b>Questionnaires</b>	Neuropsychiatric symptoms	Neuropsychiatric Inventory (NPI)
	Depressive symptoms	Geriatric Depression Scale (GDS)
	Informant questionnaire	Informant Questionnaire for Cognitive Decline in the Elderly (IQ CODE)
	Functional assessment	Instrumental Activities for Daily Living-Elderly (IADL-E)
	Quality of life	RAND Short Form Health Survey (RAND SF-36)

### **5.1. MONTREAL COGNITIVE ASSESSMENT (MoCA)**

The Montreal Cognitive Assessment (MoCA) was created in 1996 by Dr. Ziad Nasreddine. It is a rapid screening instrument with a total score of 30-points. It assesses different cognitive domains: attention and concentration, executive functions, memory, language, visuoconstructional skills, conceptual thinking, calculations, and orientation.

**Test Duration:** 5-10 minutes.

### **5.2. TRAIL MAKING TEST BLACK & WHITE (TMT A & B-B & W)**

The TMT-B&W is a measure of attention, speed, and mental flexibility. It also tests spatial organization, visual pursuits, recall, and recognition. TMT A requires the individual to draw lines to connect 25 encircled numbers distributed on a page. It tests visual scanning, numeric sequencing, and visuomotor speed. TMT B is similar except the person must alternate between numbers and circles in two colors (black and white). This is believed to be more difficult and takes longer to complete. TMT B tests executive processes of task-set inhibition, cognitive flexibility and the ability to maintain a response set (McMorris, 2016). Both sections are timed, and the score represents the amount of time required to complete the task. A difference in performance between A and B was also derived, as it's known to give an executive function index (Hashimoto et al. 2006).

**Test Duration:** 5-10 minutes.

### **5.3. CATEGORY FLUENCY**

The Category Fluency task is a test of executive function, language and semantic memory. The participant is expected to generate words that belong to a semantic category. For example, the Animal Names Test (Lezak,1995) requires the participants to generate names of animals for one minute. The ICMR-NCTB includes three categories including animals, vegetables and food. As it's a time bound test, people with slow psychomotor speed of processing may perform poorly on the task.

**Test Duration:** 1 minute for each category

#### **5.4. PHONEMIC FLUENCY**

The phonemic/letter fluency task is a test of executive function and the ability to retrieve specific information by using executive control, selective attention, mental set shifting and self-monitoring. The participant generates as many words they can with a given letter (e.g., Ka, Ma, Pa) within a minute. Being a time bound test, people with slow psychomotor speed of processing may perform poorly on the task.

**Test Duration:** 1 minute for each letter/phoneme

#### **5.5 VERBAL LEARNING TEST (from Kolkata Cognitive Screening battery)**

The Verbal Learning Test is a measure of episodic memory. The list was taken from the adapted CERAD ten-word list learning task, used in the Indo-US dementia study. It is a list of ten unrelated words that is administered over three trials, followed by a 20 minutes delayed recall. This test measures immediate recall, delayed recall and recognition memory.

The Verbal Learning Test - Hindi version was translated into Telugu, Kannada and Malayalam. The available translated and validated version (Das et al., 2006) of the test was used for the Kolkata centre.

**Test Duration:** 20 - 30 minutes

#### **5.6 TNI-93**

TNI-93 (French acronym of “Test des Neuf Images du 93”, i.e., Nine Images test of the district of Seine-Saint-Denis) is a short, easy to administer test of episodic memory. It does not require proficiency in writing or reading any language and therefore, can be effectively administered to illiterate and low educated populations. The test was developed to assist in neuropsychological testing of dementia with illiterate and low educated populations.

**Test Duration:** 10 minutes

## **5.7 PICTURE NAMING TEST (PNT)**

The Picture Naming Test (PNT) is a tool to measure confrontational word retrieval, language and semantic memory. The participant is expected to produce names for 30 line drawings presented. If the participant fails to name the drawing or makes an error, they are given a category cue to aid naming. If they are still unable to produce the name, a phonemic cue is provided to aid naming.

**Test Duration:** 3 - 10 minutes

## **5.8. FRENCHAY'S APHASIA SCREENING TEST (FAST)**

The Frenchay's Aphasia Screening Test was developed for use by non-specialists, such as junior medical staff, nurses, occupational therapists and others, to assist in identifying patients who have difficulties understanding, using spoken language, reading or writing. This test is brief and simple to administer, can be used in a busy ward or home and has good reliability when used by non-specialists. The test comprises of a manual with clear directions, clear picture material, a photocopiable administration form and updated information on the 'Use of the Frenchay's Aphasia Screening Test in Research' written by Professor Pamela Enderby.

**Test Duration:** 5- 10 minutes

## **5.9. MODIFIED TAYLOR COMPLEX FIGURE TEST (MTCF)**

The Modified Taylor Complex Figure (MTCF) Test is a test of visuo-constructive ability; it was developed by Anita Hubley in 1998. This test consists of a complex design that is abstract in nature and cannot be named easily. It has an overall structure and multiple sub-components within it. Visual learning and memory is tested with the learning and memory of abstract designs and faces. The MTCF is used to test this ability. The figure from the MTCF is copied first and recalled later. Immediate and delayed recall scores are obtained.

**Test Duration:** 30 minutes

## **5.10. LINE BISECTION TEST**

The Line Bisection Test is a quick measure to detect the presence of unilateral spatial neglect (USN). To complete the test, one must place a mark with a pencil through the center of a series of horizontal lines. Usually, a displacement of the bisection mark towards the side of the brain lesion is interpreted as a symptom of neglect. Performance on the Line Bisection Test may be influenced by or may be indicative of other syndromes besides spatial neglect, such as hemianopia (damage of optic pathways that result in loss of vision in half of the visual field) (Ferber & Karnath,2001). Consequently, the Line Bisection Test is not a highly specific measure of USN.

**Test Duration:** 3 – 5 minutes

## 6. Testing procedure, instructions for administering the tests and scoring

### 6.1. MONTREAL COGNITIVE ASSESSMENT (MoCA)

#### Administration

##### 1. Alternating Trail Making:

Administration: The examiner instructs the subject: *"Please draw a line, going from a number to a letter in ascending order. Begin here [point to (1)] and draw a line from 1 then to A then to 2 and so on. End here [point to (E)]."*

##### 2. Visuo-constructional Skills (Cube):

Administration: The examiner gives the following instructions, pointing to the **cube**: *"Copy this drawing as accurately as you can, in the space below"*.

##### 3. Visuo-constructional Skills (Clock):

Administration: Indicate the right third of the space and give the following instructions: *"Draw a clock. Put in all the numbers and set the time to 10 past 11"*.

##### 4. Naming:

Administration: Beginning on the left, point to each figure and say: *"Tell me the name of this animal"*.

##### 5. Memory

Administration: The examiner reads a list of 5 words at a rate of one per second, giving the following instructions: *"This is a memory test. I am going to read a list of words that you will have to remember now and later on. Listen carefully. When I am through, tell me as many words as you can remember. It doesn't matter in what order you say them"*.

Mark a check in the allocated space for each word the subject produces on this first trial. When the subject indicates that (s)he has finished (has recalled all words), or can recall no more words, read the list a second time with the following instructions: *"I am going to read the same list for a second time. Try to remember and tell me as many words as you can, including words you said the first time."* Put a check in the allocated space for each word the subject recalls after the second trial.

At the end of the second trial, inform the subject that (s)he will be asked to recall these words again by saying, *“I will ask you to recall those words again at the end of the test.”*

## **6. Attention:**

Forward Digit Span:

Administration: Give the following instruction: *“I am going to say some numbers and when I am through, repeat them to me exactly as I said them”*. Read the five-number sequence at a rate of one digit per second.

Backward Digit Span:

Administration: Give the following instruction: *“Now I am going to say some more numbers, but when I am through you must repeat them to me in the backwards order.”* Read the three-number sequence at a rate of one digit per second.

Note: Specific examples can be given in the backward digit span, if that helps the instructions easier to understand. If the tester is simplifying the instructions- saying in terms of money to make it easier. He/she has to make note of that.

Vigilance:

Administration: The examiner reads the list of letters at a rate of one per second, after giving the following instruction: *“I am going to read a sequence of letters. Every time I say the letter A, tap your hand once. If I say a different letter, do not tap your hand”*.

Serial 7s:

Administration: The examiner gives the following instruction: *“Now, I will ask you to count by subtracting seven from 100, and then, keep subtracting seven from your answer until I tell you to stop.”* Give this instruction twice if necessary.

## **7. Sentence repetition:**

The examiner gives the following instructions: *“I am going to read you a sentence. Repeat it after me, exactly as I say it [pause]: **I only know that Raju is the one to help today.**”* Following the response, say: *“Now I am going to read you another sentence.*

*Repeat it after me, exactly as I say it [pause]: **The cat always hid under the sofa when dogs were in the room.**”*

### **8. Verbal fluency:**

Administration: The examiner gives the following instruction: *“Tell me as many words as you can think of that begin with a certain letter of the alphabet that I will tell you in a moment. You can say any kind of word you want, except for proper nouns (like Babu or Bangalore), numbers, or words that begin with the same sound but have a different suffix, for example, love, lover, loving. I will tell you to stop after one minute. Are you ready? [Pause] Now, tell me as many words as you can think of that begin with the letter P. [time for 60 sec]. Stop.”*

### **9. Abstraction:**

Administration: The examiner asks the subject to explain what each pair of words has in common, starting with the example: *“Tell me how an orange and a banana are alike”*. If the subject answers in a concrete manner, then say only one additional time: *“Tell me another way in which those items are alike”*. If the subject does not give the appropriate response (fruit), say, *“Yes, and they are also both fruit.”* Do not give any additional instructions or clarification. After the practice trial, say: *“Now, tell me how a train and a bicycle are alike”*. Following the response, administer the second trial, saying: *“Now tell me how a scale and a watch are alike”*. Do not give any additional instructions or prompts.

### **10. Delayed recall:**

The examiner gives the following instruction: *“I read some words to you earlier, which I asked you to remember. Tell me as many of those words as you can remember.”* Make a check mark (√) for each of the words correctly recalled spontaneously without any cues, in the allocated space.

Optional: Following the delayed free recall trial, prompt the subject with the semantic category cue provided below for any word not recalled. Make a check mark (√) in the allocated space if the subject remembered the word with the help of a category or multiple-choice cue. Prompt all non-recalled words in this manner. If the subject does not recall the word after the category cue, give him/her a multiple-choice trial, using the following example instruction, *“Which of the following words do you think it was, EYE, FACE, or HAND?”*

Use the following category and/or multiple-choice cues for each word, when appropriate:

	<b>Category Cue</b>	<b>Multiple choice</b>
EYES	Part of the body	Nose, Eyes, Ear
SAREE	Type of clothing	Dupatta/Stole, Saree, Lungi
TEMPLE	Type of building	Temple, School, Hospital
ROSE	Type of flower	Jasmine, Rose, Marigold
BLUE	Type of color	White, Red, Blue

### **11. Orientation:**

Administration: The examiner gives the following instructions: “Tell me the date today”. If the subject does not give a complete answer, then prompt accordingly by saying: “*Tell me the [year, month, exact date, and day of the week].*” Then say: “*Now, tell me the name of this place, and which city it is in.*”

### **Scoring:**

#### **1. Alternating Trail Making:**

Scoring: Allocate one point if the subject successfully draws the following pattern:

1–A- 2- B- 3- C- 4- D- 5- E, without drawing any lines that cross. Any error that is not immediately self-corrected earns a score of 0.

#### **2. Visuo-constructional Skills (Cube):**

Scoring: One point is allocated for a correctly executed drawing.

- Drawing must be three-dimensional
- All lines are drawn
- No line is added
- Lines are relatively parallel and their length is similar (rectangular prisms are accepted)

A point is not assigned if any of the above-criteria are not met. Orientation and size do not matter.

### **3. Visuo-constructional Skills (Clock):**

Scoring: One point is allocated for each of the following three criteria:

1. Contour (1 pt.): the clock face must be a circle with only minor distortion acceptable (e.g., slight imperfection on closing the circle);
2. Numbers (1 pt.): all clock numbers must be present with no additional numbers; numbers must be in the correct order and placed in the approximate quadrants on the clock face; Roman numerals are acceptable; numbers can be placed outside the circle contour;
3. Hands (1 pt.): there must be two hands jointly indicating the correct time; the hour hand must be clearly shorter than the minute hand; hands must be centred within the clock face with their junction close to the clock centre.

A point is not assigned for a given element if any of the above-criteria are not met. Shape of the clock does not matter, either square, rectangle or circle shape is acceptable.

### **4. Naming:**

Scoring: One point each is given for the following responses: (1) lion (2) rhinoceros or rhino (3) camel or dromedary.

### **5. Memory**

Scoring: No points are given for Trials One and Two.

### **6. Attention:**

Scoring: Allocate one point for each sequence correctly repeated, (*N.B.*: the correct response for the backwards trial is 2-4-7).

### **Vigilance:**

Scoring: Give one point if there is zero to one error (an error is a tap on a wrong letter or a failure to tap on letter A).

### **Serial 7s:**

Scoring: This item is scored out of 3 points. Give no (0) points for no correct subtractions, 1 point for one correct subtraction, 2 points for two-to-three correct subtractions, and 3 points

If the participant successfully makes four or five correct subtractions. Count each correct subtraction of 7 beginning at 100. Each subtraction is evaluated independently; that is, if the participant responds with an incorrect number but continues to correctly subtract 7 from it, give a point for each correct

subtraction. For example, a participant may respond “92 – 85 – 78 – 71 – 64” where the “92” is incorrect, but all subsequent numbers are subtracted correctly. This is one error and the item would be given a score of 3.

### **Sentence repetition:**

Scoring: Allocate 1 point for each sentence correctly repeated. Repetition must be exact. Be alert for errors that are omissions (e.g., omitting "only", "always") and substitutions/additions (e.g., "John is the one who helped today;" substituting "hides" for "hid", altering plurals, etc.).

### **7. Verbal fluency:**

Scoring: Allocate one point if the subject generates 11 words or more in 60 sec. Record the subject's response in the bottom or side margins

### **8. Abstraction:**

Scoring: Only the last two item pairs are scored. Give 1 point to each item pair correctly answered.

The following responses are acceptable:

Train-bicycle = means of transportation, means of travelling, you take trips in both;

Scale-watch = measuring instruments, used to measure.

The following responses are **not** acceptable: Train-bicycle = they have wheels; Scale- watch=they have numbers.

### **9. Delayed recall:**

Scoring: Allocate 1 point for each word recalled freely without any cues.

**No points are allocated for words recalled with a cue.** A cue is used for clinical information purposes only and can give the test interpreter additional information about the type of memory disorder. For memory deficits due to retrieval failures, performance can be improved with a cue. For memory deficits due to encoding failures, performance does not improve with a cue.

### **10. Orientation:**

Scoring: Give one point for each item correctly answered. The subject must tell the exact date and the exact place (name of hospital, clinic, office). No points are allocated if subject makes an error of one day for the day and date.

## **TOTAL SCORE:**

Sum all sub scores listed on the right-hand side. Add one point for an individual who has 12 years or fewer of formal education, for a possible maximum of 30 points. A final total score of 26 and above is considered normal.

## **6.2. TRAIL MAKING TEST BLACK & WHITE (TMT B & W)**

### **Administration**

There are two parts in the TMT B & W test. Both parts of the test consist of 25 circles distributed over a sheet of paper. In Part A, the circles are numbered 1 – 25, and the participant should draw lines to connect the numbers in ascending order (irrespective of the color of the circle). In Part B, the circles include numbers (1 – 25) in both black and white circles. In Part B, the patient draws lines to connect the encircled numbers in an ascending pattern, similar to Part A but with the added task of alternating between black and white encircled numbers (i.e., 1 in white circle-2 in black circle-3 in white circle-4 in black circle-5 in white circle-6 in black circle, etc.).

**Materials required:** TMT- B & W Part A and B practice and test sheets, pen/pencil and stopwatch.

### **Instructions**

**Part A:** Tell the participant: *“Please connect the circles (irrespective of the color of the circle) in ascending order, as quickly as possible, without lifting the pen or pencil from the paper”.*

**Part B:** Tell the participant: *“Please connect the circles in ascending pattern alternating between white and black circles, as quickly as possible, without lifting the pen or pencil from the paper.”*

Time the patient as he/she connects the "trail". If the patient makes an error, point it out immediately and allow the patient to correct it. Errors affect the patient's score only in that the correction of errors is included in the completion time for the task. It is unnecessary to continue the test if the patient has not completed both parts after five minutes has elapsed.

**Step 1:** Give the patient a copy of the TMT-B&W Part A worksheet and a pen or pencil.

**Step 2:** Demonstrate the test to the patient using the sample sheet (TMT-B&W-Part A – *SAMPLE*).

**Step 3:** Time the patient as he or she follows the “trail” made by the numbers on the test.

**Step 4:** Record the time using a stopwatch.

**Step 5:** Repeat the procedure for TMT-B&W- Part B.

### **Scoring**

Performance for both TMT B & W, Part A and B are reported as the number of seconds required to complete the task. Higher scores reveal greater impairment. A difference in performance on time taken across the two tasks provides a measure of executive function. This can be derived by subtracting time taken to complete TMT A from TMT B (TMT B – TMT A).

## **6.3. CATEGORY FLUENCY TESTS**

### **Administration**

For each of the fluency tasks, the participant is asked to generate the names of as many items in that category as possible in one minute. There are 3 fluency tasks that will be administered. The order in which the 3 tasks are administered should be changed for every participant. Also, the language of testing should be specified to the participant and the tester should give the instructions in the same language.

**Material Required:** Response sheets, pen, stopwatch

#### **6.3.1. Animal Fluency**

### **Instructions**

Tell the participant: *"Name as many animals as possible. It can begin with any letter. Do not repeat names that you have already given once. You will be given one minute."*

### **Scoring**

Record the responses and the total number of animals that the participant generates. Then, count the

total number of correct words, which do not include higher order categories when specific exemplars are given (e.g., "fish" followed by "salmon" and "trout" --- total = 3; correct = 2). All types of animals are accepted, including insects, humans, prehistoric, extinct as well as mythical creatures (e.g., unicorn).

Total score will be only correct responses in the target language. However, other language correct responses will also be scored separately (marked as OL in the data entry sheet for correct answer). Borrowed words, which are part of the target language, will be scored as correct response (e.g., "giraffe").

### **6.3.2. Vegetables**

#### **Instructions**

Tell the participant: *"Name as many vegetables as possible. It can begin with any letter. Please do not say names of fruits. Do not repeat names that you have already given once. You will be given one minute."*

#### **Scoring**

Record the responses and the total number of vegetables that the participant generates. Then, count the total number of correct words, which do not include higher order categories when specific exemplars are given (e.g., "leafy vegetables" followed by "spinach" and "lettuce" --- total = 3; correct = 2). All types of vegetables are accepted.

Total score will be only correct responses in the target language. However, other language correct responses will also be scored separately (marked as OL in the data entry sheet for correct answer). Borrowed words, which are part of the target language, will be scored as correct response (e.g., "beans").

### **6.3.3. Food Items**

#### **Instructions**

Tell the participant: *"Name as many food items as possible. It can begin with any letter. Please do*

*not say the names of fruits and vegetables. Do not repeat names that you have already given once. You will be given one minute."*

### **Scoring**

Record the responses and the total number of food items that the participant generates. Then, count the total number of correct words, which do not include higher order categories when specific exemplars are given (e.g., "pastry" followed by "chocolate pastry" and "black forest pastry" --- total = 3; correct = 2). All types of food items are accepted.

Total score will include all correct responses in any language. The number of correctly named items generated forms the score.

### **Errors Analysis**

Qualitative errors include semantic errors, perseverative errors (e.g. rat, rat, rat), repetition errors (e.g. rat, dog, monkey, rat), super ordinate category error (e.g. animal) etc.

## **6.4. PHONEMIC FLUENCY**

### **Instructions**

The examiner gives the following instruction: *"Tell me as many words as you can think of that begin with a certain letter of the alphabet that I will tell you in a moment. You can say any kind of word you want, except for proper nouns (like Rama or Rajasthan), numbers, or words that begin with the same sound but have a different suffix, for example, love, lover, loving. I will tell you to stop after one minute. Are you ready? Example: Sound "DA"- Day, Dish, Duke, Dinner, Date, Duck, Delta, Delay, Daisy.*

[Pause]

*"Now, tell me as many words as you can think of that begin with the letter Pa.*

[Time for 60 sec].....*Stop.*"

*"Now, tell me as many words as you can think of that begin with the letter Ka.*

[Time for 60 sec].....*Stop.*"

*“Now, tell me as many words as you can think of that begin with the letter Ma.*

*[Time for 60 sec].....Stop.”*

### **Scoring**

The number of correctly named items generated forms the score.

### **Error Analyses**

Qualitative errors include, perseverative errors, repetition errors, super ordinate category error etc.

## **6.5. VERBAL LEARNING TEST (from Kolkata Cognitive Screening battery)**

### **Administration**

The aim of the Verbal Learning Test is to measure the immediate and delayed recall of the participant on a list of 10 words. The immediate recall is done immediately, and the delayed recall is measured after distraction tasks are administered in between. The distraction tasks should be of 15-20 minutes.

**Material Required:** Response sheet, pen

### **Instructions**

Tell the participant *“I will read 10 words from this paper. Listen to them carefully and repeat them in any order after I finish reading the word aloud”. Remember I will ask you to recall these words later.”* Same instructions repeated for the 2nd and 3rd trial.

**Trial 1:** Butter, Arm, Corner, Letter, Queen, Ticket, Grass, Stone, Book, Stick

**Trial 2:** Ticket, Book, Butter, Corner, Stone, Arm, Queen, Letter, Stick, Grass

**Trial 3:** Queen, Grass, Arm, Book, Stick, Corner, Butter, Stone, Ticket, Letter

**Scoring:** One point for each word correctly recalled. Maximum score: 30

### **Delayed Word List Memory Task**

*“Few minutes ago, I read out a list of 10 words from this paper. Tell me those words again.”*

**Scoring:** One point for each correct word recalled. Maximum score: 10

### **Delayed Recognition Word Task**

*“Few minutes ago, I read out 20 words from this paper. Tell me whether “tree” was there on the list.”*- If the patient gives correct response, say “correct” or if he/she gives “incorrect” response, then say this is incorrect and continue for next word.

**(Stimuli list:** Butter, Temple, Arm, Tea, Key, Corner, Five, Letter, Hotel, Mountain, Queen, Book, Shoe, Stick, Village, Thread, Ticket, Soldier, Grass, Stone)

**Scoring:** One point for each word correctly recognized. Maximum score: 20

## **6.6. TNI-93**

### **Administration**

#### **Picture Naming Task:**

Participants complete a naming task based on the semantic category given by the examiner and are asked to remember the name and the location of the 9 pictures (a duck, a bike, a guitar, a carrot, an ear, a chair, a grape, a shoe, and a fork) shown to them.

**Instructions:** *“I will show a board with 9 pictures. You should try and memorize the name and the location of these images on the board, as I will ask you about these pictures just now. We will learn them together one by one, taking our time learning them.”*

Show the board with the 9 images now:

Duck  
Bicycle  
Tabla  
Carrot  
Ear  
Chair  
Grapes  
Shoe  
Spoon

*“Look at the sheet in front of you. Can you please tell me what is the name of: the animal ( ), the*

*mode of transport ( ), the musical instrument ( ), the vegetable ( ), the body part ( ), the piece of furniture ( ), the fruit ( ), the clothing item ( ), the kitchen utensil ( ).*”

**Immediate Recall:**

For immediate recall, pictures are masked and the participants are asked to name the pictures. In case of inability to recall, the board is shown again and the participant is asked to name the missed items. The board is covered again and a cued recall process is initiated in which the participants are given semantic cues to assist in recall and the participant is asked to name the missing items. For this process, same semantic encoding cues are used as before. The number of trials taken to register all the 9 items correctly are noted down.

**Instructions:** *“Look at the sheet in front of you. Can you please tell me what was the name of: the animal ( ), the mode of transport ( ), the musical instrument ( ), the vegetable ( ), the body part ( ), the piece of furniture ( ), the fruit ( ), the clothing item ( ), the kitchen utensil ( ).”*

**Interference Test:**

An interference task of counting backward by 3 from 40 is introduced for 20 seconds.

**Instructions:** *“Count backwards from 40 taking away 3 from it. Keep doing that until I ask you to stop”:* **37      34      31      28      25**

**Free Recall:**

The participants are then asked to name as many pictures as they can within 2 minutes.

**Instructions:** *“Name the pictures that you remember.”*

**Cued Recall:**

For the forgotten items, the cued recall process is initiated again in which the participants are given semantic cues to assist in recall. For this process, same semantic encoding cues are used as before.

**Instructions:** *“Let me help you. What is the name of: the animal, the mode of transport, the musical instrument, the vegetable, the body part, the piece of furniture, the fruit, the clothing item, the kitchen utensil?”*

### **Spatial Recall:**

For Spatial Recall, the participants are shown the images one by one in the following order and asked to locate it on a blank board.

**Chair Shoe Duck Carrot Tabla Bicycle Spoon Ear Grapes**

**Instructions:** *For every image being shown, the subject is asked, “Where would you find this image on the board?”*

**Chair** |\_\_\_\_\_| **(6) Shoe** |\_\_\_\_\_| **(8) Duck** |\_\_\_\_\_| **(1)**

**Carrot** |\_\_\_\_\_| **(4) Tabla** |\_\_\_\_\_| **(3) Bicycle** |\_\_\_\_\_| **(2)**

**Spoon** |\_\_\_\_\_| **(9) Ear** |\_\_\_\_\_| **(5) Grapes** |\_\_\_\_\_| **(7)**

**Materials required:** TNI-93 board, scoring sheet

### **Scoring:**

Recall scores and intrusions are noted for each step mentioned above.

Total Recall = Free Recall + Cued Recall

Total Intrusions = Sum of all intrusions

## **6.7. PICTURE NAMING TEST (PNT)**

### **Administration**

Participants are asked to identify each item by telling the name for the item on the stimulus card. The test administrator shows the person each of the pictures, one at a time in the pre-determined order. The person is given a maximum of 10 seconds to say what the drawing depicts. If the participant is unable to name the picture or makes an error in naming the picture in maximum of 10 seconds, then a category cue is provided. If after the maximum of 10 seconds after the category cue being provided, the participant is still unable to name or makes an error, then a phonemic cue is provided. If after a maximum of 10 seconds after the phonemic cue, the participant still is unable to name or makes an error, then the tester moves onto the next picture.

Maximum time allowed for each picture = 30 seconds.

**Material Required:** 30 stimuli cards, response sheet and a stop watch.

### **Instructions**

*“I will now be showing you some pictures. You have to look at each of these pictures and tell me the name of each picture. Some of these pictures will have many different names but should tell me the most common name. If you are not sure about the name just guess. So, shall we begin? Now tell me the name of this picture.”*

1. The participant is expected to name the picture spontaneously.
2. If the participant is unable to name the picture or makes an error, provide a semantic cue after a maximum of 10 seconds delay.

If the participant is still unable to name the picture or makes an error, provide a phonemic cue after a further 10 seconds delay participant.

Maximum time allowed per picture = 30 seconds

Repeat this process for all the pictures in the list.

### **Scoring**

The responses are coded as follows:

1. Correct response in testing language = 3 points
2. Correct response in other languages = 3 points
3. Response after semantic cue = 2 points
4. Correct response after semantic cue in other languages = 2 points
5. Response after phonemic cue = 1 point
6. Response after phonemic cue in other language = 1 point

### **Error responses**

The errors will be coded as follows in the data entry sheet.

1. Error/incorrect responses will be coded as “ER” for items in free naming and for naming with semantic/category cue.
2. Incorrect response (after both the cues are given) = will be coded as “0”
3. If the participant is unable to name the item after all the cues then it is coded as “No responses” or “Don’t Know” = NR/DK

## **6.8. FRENCHAY APHASIA SCREENING TEST (Indian Adaptation)**

### **Administration**

The FAST has been designed to cover the four major aspects of language, which may be disturbed in the aphasic patient: comprehension, expression, reading and writing. It has not been designed to test for articulatory disturbances of speech, such as dysarthria, or for speech apraxia, which rarely occurs without some degree of aphasia. It has been developed for use with, and tested on, patients seen within days or weeks of an acute stroke.

**Material Required:** Picture card with attached reading cards, pencil and papers, stopwatch or watch with seconds' hand.

**Check:** Patient is wearing spectacles (if needed). Patient can hear you adequately (raise voice if necessary). It is recommended that the tests be performed in the given order. Instruction should be given clearly but only once (if instruction requires repetition, score as an error). If a patient cannot be assessed on a subtest, e.g., because of paralysis or visual impairment, mark 'u' for un-assessable.

### **Comprehension**

This is tested using the two drawings on either side of the test card. These drawings were chosen after trials of six designs of differing sizes and complexity. Patients are given instructions, of graded length and linguistic difficulty, to point to various objects, etc. For example, 'point to a boat'; 'before pointing to a duck near the bridge, show me the middle hill'; 'point to the square, the cone and the semicircle'. One point is scored for each fully correct response, giving a total of ten points. Full instructions are given in the administration form.

### **Expression**

The patient is asked to describe the picture. Scoring reflects the complexity of the response. For example, naming only 1-2 objects scores 1, naming 5-7 scores 3. The patient is also asked to name as many animals as he can think of in 60 seconds; the score depends upon the number

named, with a maximum score for naming 15. Again, details are given on the administration form.

## **Reading**

Five written instructions, again of graded difficulty, are provided. They should be shown to the patient in sequential order. One point is given for each correct response. For example, ‘show me the bridge’; ‘touch the bottom of the card and then the top of it’.

## **Writing**

The patient is asked to write a description of the picture. There is a maximum time of five minutes given for this task but frequently the more able patient, or the patient who is unable to attempt the task, will take much less time. The score depends upon the number of correctly spelled words used, and the level of grammatical construction used.

## **Abbreviated version of the FAST**

The technical data demonstrates that the presence, or absence, of aphasia can be reliably identified even when the reading and writing subtests are omitted, which shortens the length of time for testing and is more practical in some situations. However, there is evidence that omissions of these items lead to specific dysgraphia or dyslexia being overlooked.

The following points should be considered when using the test.

1. Check that the patient is wearing any necessary hearing aid or spectacles.
2. It is recommended that the tests are performed in the given order.
3. Instruction should be given clearly but only once (if instruction requires repetition, score as an error).
4. If a patient cannot be assessed on a subtest, e.g. because of paralysis or visual impairment, mark ‘u’ for un-assessable.

## 6.9. MODIFIED TAYLOR COMPLEX FIGURE TEST (MTCF)

### Administration

This test of visuo-constructive ability was developed by Anita Hubley in 1998. The test consists of a complex design, which is abstract in nature and cannot be named easily. It has an overall structure and multiple sub-components within it. Visual learning and memory is tested with the learning and memory of abstract designs and faces. The MTCF is used to test this ability. The figure from the MTCF is copied first and recalled later. Immediate and delayed recall scores are obtained.

**Material Required:** Design card, blank paper, pencil

### Instructions

**Copy Task:** *“Please look at the drawing carefully. Now copy the figure on the sheet in front of you.”*

**Immediate Recall Task** (1 min after copy trial): *“Now please try and recall the figure that I showed you earlier and draw it on the paper in front of you.”*

**Delayed Recall Task** (20 min after immediate recall trial): *“Earlier, you were shown a drawing that you copied and later drew from memory. Please draw the figure again on the paper in front of you.”*

## Scoring

Detail 1	The large square must look like a square and not be a rectangle. If the square is incomplete or if there are any other distortions (besides it being a rectangle), a score of one-half is given.
Detail 2	The crossed diagonal lines must touch each of the four corners of the square and must intersect in the middle of the square.
Detail 3	The horizontal midline of the square must go clearly across from the midpoint of the left side of the square to the midpoint of the right side of the square in one unbroken line.
Detail 4	The vertical midline must start at the midpoint of the bottom of the square and go through in one unbroken line to the midpoint at the top of the square. In scoring for position for Details 2,3 and 4, these details should intersect at the midpoint of the square. Usually, if they are not, only one is scored as incorrect for position. Very seldom, all three are scored as incorrect for not being in position.
Detail 5	The short horizontal line in the upper right quadrant of the square must start at the midpoint of the upper half of Detail 4 and stop in the middle of the upper right quadrant (or touch the section of Detail 2 in the quadrant, if present).
Detail 6	The short diagonal line in the upper right quadrant of the square must start in the upper left corner of that quadrant and stop in the middle of the quadrant (or touch the same section of Detail 2 as described in Detail 5).
Detail 7	The diagonal arrow extending up from the top right corner of the square should be a continuation of that section of Detail 2. It should not extend more than one- third of the length of the upper right quadrant portion of Detail 2.
Detail 8	The triangle in the right half of the square should have the right side of the square as its base. The base of the triangle should begin and end in the middle third of the top and bottom halves of the right side of the squares. The apex of the triangle must be in the middle third of the right half of the square. Two vertical lines, dividing the triangle into equal parts and touching both sides of the triangle, must be present.
Detail 9	The base of the semi-circle should begin and end in the middle third of the top and bottom halves of the right side of the square. Two dots (not circles) lined up vertically within the bottom half of the semi-circle must be present.
Detail 10	A small equilateral triangle must be attached by its apex to the bottom right corner of the square by a short horizontal line. The triangle must be approximately the same size as Detail 17 with an altitude not more than one-third of the height of the large square and not smaller than one-eighth the height of the small square.
Detail 11	A horizontal line should extend across the width of the lower third of the lower right quadrant of the square.
Detail 12	There should be a curved line with a short straight line bisecting each of the two outer peaks of the curve in the lower left quadrant of the square. The curved line should extend completely from the upper left corner to the bottom right corner of the quadrant.
Detail 13	A large triangle should be attached to the top and bottom points of the left side of the square. The height of the triangle should not be more than half the width of the square. The apex of the triangle should be even with Detail 3.
Detail 14	There should be four evenly spaced horizontal lines within the bottom half of Detail 13. These lines should touch both sides of the triangle. The top line should not be an extension of Detail 3.
Detail 15	A vertical arrow should extend down from the apex of Detail 13 and be no shorter than one-quarter, or no longer than one-third, the height of the square.
Detail 16	A horizontal and a vertical line should bisect the upper left quadrant of the square. These lines should touch each side of the quadrant and intersect at the midpoint of the quadrant.
Detail 17	There should be a circle in the middle of the upper left quadrant of the square. These lines should touch each side of the quadrant and intersect at the midpoint of the quadrant.
Detail 18	There should be a rectangle above the top left quadrant of the square. Its left and right sides should be extensions of the left side of the square and of Detail 4 (or the midpoint of the top of the square if Detail 4 is not present). Its height should be less than one-quarter of the height of the square. Six evenly spaced vertical lines should be present and should not touch either the top or bottom sides of the rectangle.

## **6.10. LINE BISECTION**

The Line Bisection Test is a quick measure to detect the presence of unilateral spatial neglect (USN). To complete the test, one must place a mark with a pencil through the centre of a series of horizontal lines. Usually, a displacement of the bisection mark towards the side of the brain lesion is interpreted as a symptom of neglect.

### **Administration**

To complete the test, one must place a mark with a pencil through the centre of a series of horizontal lines.

**Material Required:** Stimulus sheet, pencil

### **Instructions**

In the bisection test, 18 lines were presented on the left, middle, and right of an A4 paper, respectively. The participant is told “*please place a short cross mark with the pencil (with their preferred or unaffected hand) in the exact middle point or centre of the series of these 18 horizontal lines*”.

### **Scoring**

The test is scored by measuring the deviation of the bisection from the true centre of the line. A deviation of more than 6 mm from the midpoint indicates USN. Omission of two or more lines on one half of the page indicates USN.

## 7. Collection of data: Healthy participants centre-wise

### 7.1. Procedure

Participants were recruited from out-patient services of neurology, geriatric, and internal medicine clinics of participating hospitals, as well as senior citizen associations and other community centres in the respective cities. The goal was to recruit individuals aged 40 years and above, with varying levels of education. Participants with normal cognition, MCI, and dementia due to neurodegenerative disease and stroke, from both clinic and community, were included in the study.

Based on clinical evaluation, the individuals who fulfilled the following inclusionary criteria were recruited: participants who were  $\geq 40$  years and consented to participate; with no evidence of head injury, infections, and neurological disorders other than stroke and neurodegenerative disease that could cause cognitive impairment; with no history of major systemic medical or psychiatric conditions that could interfere with cognition; and with no significant hearing or visual impairment that could interfere with cognitive testing.

All study participants underwent cognitive assessment using tests that have been standardised to the local populations, referred to as “Gold standard battery” for which normative data were available, and have been in use for clinical diagnosis and research. This battery consists of the cognitive screening test Addenbrooke’s Cognitive Examination-III (ACE-III) and the Clinical Dementia Rating (CDR), which is administered in all participants. In addition, in participants with no dementia or questionable dementia (CDR 0 and 1), tests of episodic memory and executive functions: Rey Auditory Verbal Learning Test (RAVLT) and Color Trails Test (CTT) were performed to identify participants with MCI. These tests have been validated and are widely used for diagnosis of MCI in India (Alladi et al., 2011, 2014; Mathuranath et al., 2007; Nandi et al., 2008; Rao et al., 2004). A participant was considered to be impaired on a test when his or her performance was below cut-off values in the gold standard battery.

Clinical diagnosis was made by a neurologist experienced in diagnosis of MCI and dementia following a semi-structured interview, clinical examination, review of performance on gold standard tests, and other available investigations. Based on a uniform diagnostic process, participants were grouped as follows:

1. **Healthy controls:** All participants who have no subjective cognitive complaints and scored normally on ACE-III, CDR, AVLT, and CTT.

2. MCI: Participants who fulfill modified Petersen's criteria for MCI (Petersen, 2004).
3. Dementia: DSM-IV criteria for dementia. Subtypes of dementia will be further diagnosed as follows:
  - Alzheimer's disease (AD): (McKhann et al., 2011).
  - Vascular dementia (VaD): NINDS-AIREN criteria (Román et al., 1993).
  - Frontotemporal dementia (FTD): (Rascovsky et al., 2011).
4. Vascular MCI: Participants with stroke who fulfill VASCOG criteria (Sachdev et al., 2014).

## **7.2. Demographic characteristics of the healthy participants across the five centres**

The original sample included 1119 participants. Median Absolute Deviation (MAD) analyses was carried out to identify the outliers which were subsequently removed. The final cohort included 991 participants. Distribution of the healthy participants are shown in Table 2.

### **7.2.1. Age**

As evident from Table 2, the overall sample is relatively young (Mean age =  $56.04 \pm 10.44$ ). Table 3 indicates that the participants across the five centres differed significantly with respect to age ( $p < 0.001$ ). Post hoc comparisons indicated that the Hindi speaking participants with the lowest mean age ( $51.01 \pm 6.06$ ) differed significantly from the Telugu ( $55.39 \pm 10.05$ ), Malayalam ( $56.24 \pm 9.61$ ), Bengali ( $55.88 \pm 9.81$ ) and the Kannada ( $62.75 \pm 12.79$ ) speaking participants. Post hoc comparisons further indicated that the Kannada speaking participants with the highest mean age ( $62.75 \pm 12.79$ ) differed significantly from the other participants (Kannada vs Telugu:  $p < 0.001$ ; Kannada vs Malayalam:  $p < 0.001$ ; Kannada vs Bengali:  $p < 0.001$ ). However, there were no differences between the participants from the other centres (Telugu vs Malayalam:  $p = 0.88$ ; Telugu vs Bengali:  $p = 0.99$ ; Malayalam vs Bengali:  $p = 1.00$ ).

### 7.2.2. Education

Table 2 shows that the overall education of the healthy participants is relatively high (Mean education =  $12.78 \pm 3.86$ ). Table 3 indicates that the participants across the five centres differed significantly with respect to education ( $p < 0.001$ ). Post hoc comparisons indicated that the Hindi speaking participants with the highest level of education (Mean =  $13.93 \pm 3.09$ ) differed significantly ( $p < 0.001$ ) from the Telugu (Mean =  $12.99 \pm 4.25$ ), Bengali (Mean education =  $11.50 \pm 4.27$ ) and the Kannada (Mean education =  $11.18 \pm 11.18$ ) speaking participants. No significant difference was observed ( $p = 0.91$ ) between the Hindi and the Malayalam speaking participants (Mean =  $13.60 \pm 3.2$ ). The Telugu speaking participants differed significantly from the Hindi ( $p = 0.05$ ), Bengali and the Kannada ( $p < 0.001$ ) speaking participants. There were no significant differences between the Telugu and the Malayalam speaking participants ( $p = 0.39$ ). The Malayalam speaking participants differed significantly from the Bengali and Kannada speaking centres ( $p < 0.001$ ). The Bengali speaking participants differed significantly ( $p < 0.001$ ) from the Telugu, Hindi and Malayalam, but not from the Kannada ( $p = 0.94$ ) speaking participants.

### 7.2.3. Gender

The ratio of male and female healthy participants was 546:445 (Table 2). The mean age of the male participants (Mean =  $56.87 \pm 10.88$ ) was significantly higher ( $p = 0.01$ ) than the female participants (Mean age =  $55.03 \pm 9.78$ ). There was a significant difference in education ( $p < 0.001$ ) between male (Mean education =  $13.24 \pm 3.6$ ) and female (Mean education =  $12.22 \pm 4.1$ ). The mean age of the male participants were significantly higher than the female participants in Telugu (Male mean age =  $57 \text{ years} \pm 10.48$ : Female mean age =  $52 \pm 8.69$ ) and Malayalam (Male mean age =  $58.44 \pm 10.51$ : Female mean age =  $54.73 \pm 8.67$ ) speaking centres ( $p < 0.001$  &  $0.01$ ). The proportion of male to female participants in Hindi (Male mean age =  $51.07 \pm 6.44$ : Female mean age =  $51.17 \pm 5.35$ ), Bengali (Male mean age =  $57.28 \pm 10.46$ : Female mean age =  $54.08 \pm 8.67$ ) and Kannada (Male mean age =  $63.50 \pm 13.44$ : Female mean age =  $62.07 \pm 12.21$ ) showed no significant differences ( $p = 0.91, 0.06$  &  $0.47$ ). The mean education of the male participants was significantly higher in the Telugu (Male mean education =  $13.92 \pm 3.64$ : Female mean education =  $11.46 \pm 4.73$ ) group ( $p < 0.001$ ). With respect to education there was no significant difference between male and female across the Hindi (Male mean education =  $13.8 \pm 2.84$ : Female mean education =  $14.16 \pm 3.5$ ), Malayalam (Male mean education =  $13.38 \pm 2.96$ : Female mean education =  $13.75 \pm 3.36$ ) and Kannada (Male mean education =  $11.43 \pm 3.57$ : Female mean education =  $10.95 \pm 3.43$ ) speaking centres ( $p = 0.47,$

0.42 & 0.39).

The proportion of male to female participants were unequal across Telugu (M:F = 189:113), Hindi (M:F = 122:69) and Malayalam (M:F = 79:116) speaking centres. The Bengali (M:F = 76:59) and Kannada (80:88) speaking centres had a more equal proportion of male and female participants.

Table 2: Demographic characteristics of the healthy participants (all centres)

Age Mean (SD)	Age (in years)					Education Mean (SD)	Education (in years)					Gender M: F
	40 – 50	51 – 60	61 – 70	71 – 80	81 – 90		1 – 4	5 – 8	9 – 12	13 – 15	>15	
56.04 (10.44)	n = 367	n = 298	n = 223	n = 82	n = 21	12.78 (3.86)	n = 16	n = 181	n = 369	n = 255	n = 230	546: 445

Table 3: Demographic characteristics of the healthy participants (centre wise)

	Centres					<i>p</i> value
	Hindi n = 191	Bengali n = 135	Telugu n = 302	Kannada n = 168	Malayalam n = 195	
<b>Age Mean (SD)</b>	51.10 (6.06)	55.88 (9.81)	55.39 (10.05)	62.75 (12.79)	56.24 (9.61)	<0.001
Age (in years)	N	N	N	N	N	
40 – 50	103	44	121	36	63	
51 – 60	67	56	81	29	65	
61 – 70	20	22	72	55	54	
71 – 80	1	13	26	32	10	
81 – 90	0	0	2	16	3	
<b>Education Mean (SD)</b>	13.93 (3.09)	11.50 (4.27)	12.99 (4.25)	11.18 (11.18)	13.60 (3.2)	<0.001
Education (in years)	n	N	N	N	N	
1-4	1	7	6	2	0	
5-8	5	27	41	43	4	
9-12	65	51	98	68	85	
13-15	68	31	62	42	52	
>15	52	19	95	10	54	
<b>Gender M: F</b>	122: 69	76: 59	189: 113	80: 88	79: 116	

#### **7.2.4. Monolinguals and Bilinguals**

The proportion of monolingual to bilingual participants was 439: 551 (Table 4). The bilingual participants were significantly older and also had more years of education than the monolingual participants ( $p < 0.001$ ). As seen in Table 5, the bilinguals were significantly older than the monolinguals in the Telugu ( $p < 0.001$ ) and Malayalam groups ( $p < 0.001$ ). However, no significant differences in age were observed between the monolingual and bilinguals in the other language groups (Hindi,  $p = 0.76$ ; Bengali,  $p = 0.33$ ; Kannada,  $p = 0.23$ ). With respect to education, the bilinguals had more years of education than the monolingual participants across the five centres ( $p < 0.001$ ).

#### **7.2.5. Occupation, Socio Economic Status (SES) and Living Conditions**

Socio economic status, urban vs rural and occupation codes were not taken into consideration for analyses as the groups were not well represented as seen in Table 4. There were 670 people from urban dwelling compared to only 128 from the rural dwelling.

#### **7.2.6. Performance of Healthy Participants on the Gold Standard tests**

Table 6 shows the performance of the healthy participants across all centres on the gold standard tests. There is a significant difference in performance across the centres on all tests except colour trails test B.

Table 4: Distribution of Language usage, Occupation, Socio-Economic Status (SES) and Living conditions (all centres)

Language usage	Monolingual	439
	Bilingual	551
Occupation groups **	1	90
	2	132
	3	252
	4	293
	5	182
	Missing	42
SES groups*	1	174
	2	464
	3	222
	4	126
	5	3
	Missing	2
Urban/Rural	Urban	670
	Rural	128
	Missing	193

\* Kuppaswamy's Socioeconomic Status (2012): 1 – Upper SES, 2 – Upper middle, 3 – Middle/Lower, 4 – Lower/ Upper Lower, 5 – Lower

\*\*Occupation: 1 - unskilled, 2 - semiskilled, 3 - skilled, 4 - professional, 5 - housewife

Table 5: Mono/bilingual status, Occupation classification, Socio-Economic Status (SES) classification and Urban/Rural status of healthy participants

		<b>Hindi</b>	<b>Bengali</b>	<b>Telugu</b>	<b>Kannada</b>	<b>Malayalam</b>
		N = 191	N = 135	N = 302	N = 168	N = 195
	Monolingual	122	65	103	61	88
	Bilingual	69	70	198	107	107
	Missing			1		
<b>Education</b>	Monolingual	13.16 (3.01)	8.49 (3.3)	9.83 (3.88)	8.39 (2.4)	11.30 (2.2)
	Bilingual	15.30 (2.76)	14.3 (2.98)	14.68 (3.37)	12.77 (3)	15.50 (2.6)
<b>Age</b>	Monolingual	51.20 (6.24)	56.74 (9.43)	52.17 (8.08)	61.18 (12.9)	54.27 (8.96)
	Bilingual	50.93 (5.75)	55.09 (10.15)	57.13 (10.55)	64.63 (12.71)	57.85 (9.86)
<b>Occupation bands</b>	N	N	N	N	N	N
1	27	8	4	51	0	
2	42	15	42	8	25	
3	33	12	84	80	43	
4	64	47	109	13	60	
5	8	51	62	16	45	
Missing	17	2	1	0	22	
<b>SES</b>	N	N	N	N	N	N
1	35	7	103	2	27	
2	94	34	116	158	62	
3	51	54	68	6	43	
4	11	40	14	2	59	
5	0	0	0	0	3	
Missing	1	0	1	0	1	
<b>Urban</b>	123	104	200	135	108	
<b>Rural</b>	33	1	39	33	22	
Missing	35	30	63	0	65	

Table 6: Performance of the healthy participants on gold standard tests

Gold Standard Test	N	Whole Group	Hindi	Bengali	Telugu	Kannada	Malayalam	<i>p</i> value
ACE III	863	90.80 (6.2)	88.36 (6.58)	88.80 (7.59)	93.56 (4.47)	90.42 (6.38)	91.62 (4.76)	<0.001
Color trails A	671	79.26 (43.57)	-	68.52 (26.79)	64.38 (24.36)	105.39 (60.28)	78.57 (39.89)	<0.001
Color trails B	667	159.60 (63.94)	-	163.36 (70.75)	153.36 (50.3)	159.55 (69.42)	163.92 (67.1)	0.37
RAVLT delayed recall (DR)	809	8.05 (3.01)	6.42 (2.12)	7.56 (2.26)	10.13 (2.92)	6.00 (2.49)	9.34 (2.52)	<0.001
RAVLT HITS	812	14.26 (1.54)	14.45 (2.01)	14.13 (1.12)	14.09 (1.19)	14.73 (1.68)	13.94 (1.43)	<0.001
HADS Anxiety	842	2.76 (3.4)	3.49 (3.49)	2.05 (1.86)	4.66 (3.99)	2.05 (2.76)	.92 (1.62)	
HADS Depression	842	2.36 (3.33)	2.54 (2.54)	.79 (1.29)	4.69 (4.14)	2.45 (2.73)	.53 (1.26)	

### 7.3. Demographic characteristics of patients across the five centres

Table 7 shows the distribution of patients across the centres. As all patient groups were not well represented across the centres only MCI, MCI due to stroke (VaMCI), AD and VaD patients were included for the validation analyses. The MCI validation was done in MCI, VaMCI, and MCI+VaMCI groups and AD and VaD were combined for the dementia validation analyses.

Table 7: Distribution of patients across the five centres

Hindi	Control	191
	MCI	48
	VaMCI	18
	AD	23
	VaD	6
	FTD	1
	Mixed	5
Bengali	Control	135
	MCI	21
	VaMCI	9
	AD	17
	VaD	17
Telugu	Control	302
	MCI	24
	VaMCI	10
	AD	18
	VaD	11
	FTD	33
	Mixed	1
Kannada	Control	168
	MCI	39
	AD	6
	VaD	4
	FTD	7
Malayalam	Control	195
	MCI	25
	VaMCI	11
	AD	18
	VaD	20

Table 8: Demographic characteristics of age, education and gender of the patients (all centres)

	<b>Healthy Participants</b>	<b>MCI</b>	<b>VaMCI</b>	<b>MCI (MCI + VaMCI)</b>	<b>AD</b>	<b>VaD</b>	<b>Dementia (AD + VaD)</b>	<b>p value</b>
N	991	157	48	205	55	51	106	
Age Mean (SD)	56.04 (10.49)	62.52 (11.77)	61.63 (11.34)	62.30 (11.64)	68.35 (8.62)	63.37 (10.02)	65.95 (12.95)	<0.001*
Education Mean (SD)	12.78 (3.86)	12.01 (3.67)	11.96 (3.16)	11.99 (3.54)	12.6 (3.54)	11.9 (3.19)	12.26 (3.38)	0.78*
Gender M: F	554:445	85: 72	38: 10	123: 82	32: 23	40: 11	72: 34	

\*p value for difference between MCI + VaMCI, AD + VaD and healthy participants.

Table 9: Demographic characteristics of age, education and gender of the patients (centre wise)

	<b>Hindi</b>	<b>Bengali</b>	<b>Telugu</b>	<b>Kannada</b>	<b>Malayalam</b>	<b>p value</b>
<b>MCI</b>	N = 66	N = 30	N = 36	N = 39	N = 34	
Age Mean (SD)	58.90 (12.19)	57.33 (11.03)	60.78 (12.73)	65.95 (11.99)	66.38 (9.13)	0.01
Education Mean (SD)	12.78 (4.13)	8.73 (4.65)	8.69 (5.15)	11.23 (2.92)	12.24 (3.29)	<0.001
Gender M:F	50:16	15: 15	19: 17	18: 21	22: 15	
<b>Dementia</b>	N = 35	N = 34	N = 63	N = 15	N = 38	
Age Mean (SD)	67.40 (11.65)	67.68 (10.87)	64.83 (9.84)	67.20 (9.11)	69.37 (7.49)	0.01
Education Mean (SD)	13.34 (3.02)	12.96 (4.28)	12.63 (5.19)	11.67 (4.25)	11.61 (3.44)	0.179
Gender M: F	22:13	21:13	36:24	7:8	30:8	

## **8. Psychometric properties of the ICMR-NCTB**

Data was tested for normality across all tests and centres. Parametric tests were administered to data that was normally distributed and non-parametric tests were carried out for data that was not normally distributed.

### **8.1. Performance of healthy participants on the ICMR – NCTB**

Tables 10, 11, and 12 show significant differences in performance on all tests across the five centres. These differences may be due to demographic differences noted above between centres.

### **8.2. Correlation of test performance with demographic characteristics across all centres**

Table 13, 14 and 15 shows the correlation between the demographic factors (age & education) and performance on all tests of the ICMR – NCTB. Although most correlations showed significant relations between the demographic variables and test performance, the correlation coefficients were rather small, most being below 0.3. Hence, the demographic variables of age and education were not used to develop norms. Centre wise regression analyses were carried out which also did not produce strong effects of the demographic characteristics. Regression analyses tables and narration are available in the centre specific manual.

Table 10: Performance of the healthy participants on tests of global cognitive function and attention & executive functions across individual centres

Tests	Whole group		Centres										p value
	Mean	SD	Hindi	Bengali		Telugu		Kannada		Malayalam			
			Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	
MoCA	26.15	3.28	27.75	2.08	22.50	4.61	26.69	2.38	25.15	2.91	27.28	2.07	< 0.001
TMT B & W													
Part A (in secs)	67.96	25.82	67.55	24.84	72.09	25.88	56.85	20.2	75.56	27.15	74.53	27.39	<0.001
Part A errors	.04	.308	.00	.000	.09	.453	.02	.142	.07	.535	.04	.220	<0.001
Part B (in secs)	167.2	60.32	172.76	58.84	179.02	68.04	161.24	56.49	143.32	53.43	180.42	59.96	<0.001
Part B errors	.14	.553	.01	.162	.31	.887	.17	.48	.15	.71	.06	.34	<0.001
Part B – A	99.40	51.26	105.91	52.48	106.57	52.14	104.74	47.68	68.26	49.56	105.89	46.83	<0.001
Category Fluency													
Animals	14.06	4.28	10.50	3.27	18.41	4.74	14.66	3.429	13.01	3.69	15.07	2.86	<0.001
Vegetable	14.09	4.49	10.17	3.53	18.28	4.27	15.54	3.75	11.99	3.56	15.45	2.84	<0.001
Food	14.57	5.51	9.99	3.34	19.76	6.7	15.32	4.54	11.43	3.2	17.42	3.68	<0.001
Phonemic Fluency													
Pa	10.19	4.4	6.54	3.36	8.46	3.04	11.91	4.46	9.57	3.27	13.02	3.71	<0.001
Ka	10.57	4.34	6.69	2.98	8.56	3.27	11.64	3.74	11.74	3.4	13.32	4.22	<0.001
Ma			6.23	2.65	8.03	3.19	9.41	4.78	10.94	3.45	10.62	4.41	<0.001
Ka+Ma+Pa	30.97	11.5	19.83	7.95	25.36	8.10	34.63	10.6	32.93	8.26	38.3	10.3	<0.001

\*p value indicates significance level of differences across centres using the Kruskal-Wallis test or ANOVA where appropriate.

Table 11: Performance of the healthy participants on tests of memory across individual centres

Tests	Whole group		Centres										<i>p</i> value
	Mean	SD	Hindi		Bengali		Telugu		Kannada		Malayalam		
			Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	
VLT													
Trial 1	5.08	1.4	4.92	1.43	5.16	1.39	5.27	1.44	5.05	1.41	4.92	1.28	0.1
Trial 2	6.48	1.54	5.88	1.52	6.70	1.72	6.80	1.48	6.02	1.32	6.81	1.43	<0.001
Trial 3	7.4	1.64	6.57	1.71	8.07	1.8	7.76	1.52	6.86	1.42	7.64	1.30	<0.001
Total Learning	18.95	3.85	17.37	4.04	19.93	4.31	19.83	3.72	17.93	3.39	19.37	3.19	<0.001
Delayed Recall	5.31	1.98	5.05	1.70	5.05	1.88	5.95	2.14	4.57	1.89	5.41	1.80	<0.001
Delayed Recognition	11.63	3.89	19.56	0.84	19.13	0.72	19.03	1.57	15.85	7.72	18.96	1.14	<0.001
MTCF													
Immediate Recall	19.72	7.12	17.12	7.49	17.74	6.5	21.39	6.65	20.21	7.61	20.33	6.47	<0.001
Delayed Recall	18.73	7.15	15.68	7.61	17.11	6.39	20.32	6.51	18.91	7.86	19.89	6.32	<0.001
TNI													
Total Recall	8.62	0.78	8.64	0.95	8.73	0.60	8.56	0.84	8.77	0.67	8.48	0.76	< 0.001
Spatial Recall	8.39	1.20	8.25	1.78	7.99	1.10	8.29	1.33	8.91	0.43	8.38	1.05	< 0.001

Table 12: Performance of the healthy participants on tests of language and visuospatial abilities across individual centres

Tests	Whole group		Centres										<i>p</i> value
	Mean	SD	Hindi		Bengali		Telugu		Kannada		Malayalam		
			Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	
<b>Language</b>													
PNT 30	85.98	5.28	88.84	2.63	81.45	7.32	86.64	3.4	88.17	3.27	83.80	5.57	<0.001
FAST adapted	27.84	2.29	27.60	2.65	28.88	1.63	27.85	1.71	27.25	3.35	27.86	1.53	<0.001
<b>Visuospatial ability</b>													
MTCF Copy	34.79	1.75	35.07	1.52	33.68	2.29	34.91	1.67	34.63	1.75	34.93	1.61	<0.001
Line Bisection	16.89	.702	17.00	.00	16.86	.465	16.72	1.24	16.93	.53	17.00	.000	<0.001

\**p* value indicates significance level of differences across centres using the Kruskal-Wallis test.

Table 13: Distribution of missing data across all tests and centres

Tests	Hindi		Bengali		Telugu		Kannada		Malayalam	
	N		N		N		N		N	
	Valid	Missing	Valid	Missing	Valid	Missing	Valid	Missing	Valid	Missing
MoCA	184	103	130	59	212	141	148	58	189	81
TMT A	243	44	182	7	281	72	174	32	255	15
TMT B	243	44	178	11	277	76	174	32	254	16
Category Fluency										
Animal	283	4	174	15	263	90	206	0	266	4
Vegetable	282	5	177	12	264	89	205	1	266	4
Food	274	13	177	12	264	89	206	0	266	4
Phonemic Fluency										
KA	273	14	171	18	260	93	186	20	266	4
MA	269	18	171	18	258	95	186	20	266	4
PA	262	25	169	20	258	95	182	24	266	4
PNT	270	17	176	13	222	131	183	23	263	7
FAST	194	93	164	25	243	110	186	20	246	24
VLT										
T1	279	8	184	5	337	16	206	0	266	4
T2	279	8	184	5	337	16	206	0	266	4
T3	279	8	184	5	337	16	206	0	266	4
DR	279	8	184	5	337	16	206	0	266	4
TL	272	15	178	11	332	21	202	4	261	9
MTCF										
Copy	264	23	130	59	295	58	172	34	258	12
Immediate Recall	263	24	130	59	295	58	172	34	258	12
Delayed Recall	167	120	76	113	252	101	131	75	182	88
TNI93totalrecall	133	154	138	51	256	97	184	22	241	29
TNI93spatialrecall	147	140	154	35	250	103	181	25	246	24
Line Bisection	198	89	181	8	244	109	206	0	254	16

Correlations were run between age, education and test scores across centres to investigate associations between test scores and age and education. Most correlations were weak, correlation coefficients being under 0.3. (Please see Tables 14, 15, & 16)

Table 14: Correlation between tests of global cognitive function attention and executive function and age & education across all centres

Tests	Whole group		Hindi		Bengali		Telugu		Kannada		Malayalam	
	Age	Edu	Age	Edu	Age	Edu	Age	Edu	Age	Edu	Age	Edu
<b>Global cognitive function</b>												
MoCA	-.130**	0.444**	-.052	.225**	-.239**	.792**	-.217**	0.226**	.169*	.135	-.076	.358*
<b>Attention and executive function</b>												
TMT B & W												
Part A	.150**	-.162**	.053	-.165*	.135	-.241**	.187**	-.167**	.331**	-.312**	.255**	-.252**
Part B	.080*	-.077*	.089	-.113	.242**	-.378**	.230**	-.198**	.049	-.028	.332**	-.323**
TMT B-A	-.046	.142**	.098	-.119	-.262**	-.332**	.21**	-.17**	-.149	.146	.292**	-.249**
Category fluency												
Animals	-.031	.135**	-.088	.219**	-.274**	.550**	-.155*	.175*	-.162*	.281**	.012	.190**
Vegetables	-.056	.131**	-.151*	.117	-.182*	.438**	-.019	.263**	-.118	.065	-.146*	.285**
Food	.077*	.178**	-.086	.214**	-.314**	.406**	-.029	.270**	-.009	-.094	-.169*	.246**
Phonemic Fluency												
Ka	.073*	.139**	-.139	.071	-.162	.442**	-.137*	.275**	.105	.239**	-.048	.344**
Ma	.042	.189**	-.152*	-.182*	-.220*	.337**	-.110	.215**	.061	.140	-.015	.401*
Pa	.075*	.192**	-.081	.083	-.070	.432**	-.114	.245*	.181*	.117	-.110	.303**
Ka + Ma + Pa	-.135**	.218**	-.114	.094	-.150	.447**	-.140*	.298*	.140	.180*	-.056	.381**

Table 15: Correlation between tests of memory and age & education across all centres

Tests	Whole group		Hindi		Bengali		Telugu		Kannada		Malayalam	
	Age	Edu	Age	Edu	Age	Edu	Age	Edu	Age	Edu	Age	Edu
Verbal Learning Test												
Trial 1	-.156**	.208**	-.121	.285**	-.183*	.290**	-.284**	.179**	.039	.026	-.212**	.081
Trial 2	-.159**	.153**	-.149*	.283**	-0.079	.408**	-.278**	.214**	.008	.120	-.236**	.089
Trial 3	-.196**	.209**	-.158*	.364**	-.197*	.395**	-.271**	.084	.023	.128	-.300**	.099
TL	-.043	.140**	-.165*	.366**	-0.17	.451**	-.324**	.191**	.006	.098	.051	.277**
Delayed Recall	-.196**	.206**	-.104	.177*	-0.151	.363**	-.326**	-.036	-.139	.205**	-.283**	.115
MTCF												
Immediate Recall	-.138**	.194**	-.246**	.066	-0.213	.315**	-.256**	.036	-.368**	-.008	-.202**	.287**
Delayed Recall	-.015	.159**	-.241**	.157*	-0.211	.296**	-.25**	.121	-.325**	.157	-.203**	.292**
TNI- 93 Total Recall	-0.069	0.064	0.108	0.123	-0.111	.506**	-.322**	-0.113	0.075	-0.094	0.010	.379**
TNI-93 Spatial Recall	-0.031	.123**	0.132	.289**	-0.183	.530**	-.138*	0.037	-0.072	-0.013	-.172*	.163*

Table 16: Correlation between tests of visuospatial ability and language and age & education across all centres

Tests	Whole group		Hindi		Bengali		Telugu		Kannada		Malayalam	
	Age	Edu	Age	Edu	Age	Edu	Age	Edu	Age	Edu	Age	Edu
PNT	-.108**	.319**	.046	.154*	-.100	.613**	-.214**	.102	.022	.059	-.096	.426**
FAST	-.172**	.165**	-.203*	.309**	-.097	.610**	-.089	.304**	-.033	.307**	-.211**	.149*
MTCF Copy	-.161**	.137**	.039	.306**	.042	.307**	-.064	.070	-.006	-.044	-.182*	.290**
Line Bisection	-	-	-	-	-.077	.339**	-.010	.191**	.055	-.006	-	-

## **9. Summary**

The ICMR-NCTB is a product of a unique project that envisioned harmonising neuropsychological test performance across the country. It is a project that is first of its kind and the need of the hour. At present there are very few freely available cognitive tools that can be used for dementia diagnosis for clinical and research purpose. The project findings are true to the diversity of India. The performance across the centres showed much heterogeneity. Much cannot be said for the reasons of disparity across the centres as the centres were not matched for age and education.

### **9.1 Limitations of the battery**

As the cohort is a younger group with a mean age of 56.04 (10.44), caution must be taken while interpreting test performance of older people for a diagnosis of dementia. The mean education of the group 12.78 (3.76) indicating a relatively well educated cohort. Performance interpretation of people with low education must be made with caution. There seem to be missing data on two tests (TMT B & W and MTCF). Caution must be placed when administering and interpreting performance on these two tests, as it may not be applicable to all.

### **9.2 Range of application**

The ICMR-NCTB was developed to use with individuals aged from 40 to 80 years. The standardization data was obtained separately in 5 Indian languages (Hindi, Bengali, Telugu, Kannada, and Malayalam) from individuals from the respective regions (Delhi, Kolkata, Hyderabad, Bengaluru, and Trivandrum). Individuals younger than 40 may be tested, however with caution as no normative data is provided for them in this manual. Testing in other languages should also be done with caution as tests can be influenced by language and ad hoc translation of tests may alter critical functions of the test.

When using the test in a language that is not the primary language for the examinee, caution must be taken about its influence on testing. Testing should ideally be carried out in the examinee's most proficient language. If the examiner does not speak the language, a translator and a translated version of the test can be used. However, the performance would need to be interpreted with caution as language appropriate norms may not be available.

### **9.3 Test score interpretation**

Normative scores assist test takers in interpreting the test results, as raw scores are not meaningful without proper interpretation. To derive norms for tests of the ICMR-Neuro Cognitive Tool Box (ICMR-NCTB), the percentile rank method is used. The percentile conversion (5<sup>th</sup> , 10<sup>th</sup>, 15<sup>th</sup>, 25<sup>th</sup> , 50<sup>th</sup> and 75<sup>th</sup> ) for raw scores for the ICMR-NCTB test are provided for five Indian languages (Hindi, Bengali, Telugu, Kannada, and Malayalam) in the respective manuals. Depending on the clinical applicability, the appropriate norms can be chosen from 5<sup>th</sup> to 75<sup>th</sup> percentile.

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**ICMR-NCTB TESTS  
(LITERATE)  
ENGLISH**

<b>Date of Interview</b>	
<b>Hospital/Institution</b>	
<b>Location</b>	
<b>Testing Language</b>	

**Name of the participant:**

**Age/Gender:**

**Years of Education:**

**Number of languages spoken:**

**Languages Spoken:**

**Age at onset of dementia/MCI:**

**Diagnosis:**

# **TESTS OF GLOBAL COGNITIVE FUNCTION**

## **MONTREAL COGNITIVE ASSESSMENT (MoCA)**

The Montreal Cognitive Assessment (MoCA) was created in 1996 by Dr. Ziad Nasreddine. It is a rapid screening instrument with a total score of 30-points. It assesses different cognitive domains: attention and concentration, executive functions, memory, language, visuoconstructional skills, conceptual thinking, calculations, and orientation.

### **Administration**

#### **1. Alternating Trail Making:**

Administration: The examiner instructs the subject: *"Please draw a line, going from a number to a letter in ascending order. Begin here [point to (1)] and draw a line from 1 then to A then to 2 and so on. End here [point to (E)]."*

#### **2. Visuo-constructional Skills (Cube):**

Administration: The examiner gives the following instructions, pointing to the **cube**: *"Copy this drawing as accurately as you can, in the space below"*.

#### **3. Visuo-constructional Skills (Clock):**

Administration: Indicate the right third of the space and give the following instructions: *"Draw a **clock**. Put in all the numbers and set the time to 10 past 11"*.

#### **4. Naming:**

Administration: Beginning on the left, point to each figure and say: *"Tell me the name of this animal"*.

#### **5. Memory**

Administration: The examiner reads a list of 5 words at a rate of one per second, giving the following instructions: *"This is a memory test. I am going to read a list of words that you will have to remember now and later on. Listen carefully. When I am through, tell me as many words as you can remember. It doesn't matter in what order you say them"*.

Mark a check in the allocated space for each word the subject produces on this first trial. When the subject indicates that (s)he has finished (has recalled all words), or can recall no more words, read the list a second time with the following instructions: *“I am going to read the same list for a second time. Try to remember and tell me as many words as you can, including words you said the first time.”* Put a check in the allocated space for each word the subject recalls after the second trial.

At the end of the second trial, inform the subject that (s)he will be asked to recall these words again by saying, *“I will ask you to recall those words again at the end of the test.”*

## **6. Attention:**

Forward Digit Span:

Administration: Give the following instruction: *“I am going to say some numbers and when I am through, repeat them to me exactly as I said them”*. Read the five-number sequence at a rate of one digit per second.

Backward Digit Span:

Administration: Give the following instruction: *“Now I am going to say some more numbers, but when I am through you must repeat them to me in the backwards order.”* Read the three-number sequence at a rate of one digit per second.

Note: Specific examples can be given in the backward digit span, if that helps the instructions easier to understand. If the tester is simplifying the instructions- saying in terms of money to make it easier. He/she has to make note of that.

Vigilance:

Administration: The examiner reads the list of letters at a rate of one per second, after giving the following instruction: *“I am going to read a sequence of letters. Every time I say the letter A, tap your hand once. If I say a different letter, do not tap your hand”*.

Serial 7s:

Administration: The examiner gives the following instruction: *“Now, I will ask you to count by*

*subtracting seven from 100, and then, keep subtracting seven from your answer until I tell you to stop.”*  
Give this instruction twice if necessary.

### **7. Sentence repetition:**

The examiner gives the following instructions: *“I am going to read you a sentence. Repeat it after me, exactly as I say it [pause]: **I only know that Raju is the one to help today.**”* Following the response, say: *“Now I am going to read you another sentence.*

*Repeat it after me, exactly as I say it [pause]: **The cat always hid under the sofa when dogs were in the room.**”*

### **8. Verbal fluency:**

Administration: The examiner gives the following instruction: *“Tell me as many words as you can think of that begin with a certain letter of the alphabet that I will tell you in a moment. You can say any kind of word you want, except for proper nouns (like Babu or Bangalore), numbers, or words that begin with the same sound but have a different suffix, for example, love, lover, loving. I will tell you to stop after one minute. Are you ready? [Pause] Now, tell me as many words as you can think of that begin with the letter P. [time for 60 sec]. Stop.”*

### **9. Abstraction:**

Administration: The examiner asks the subject to explain what each pair of words has in common, starting with the example: *“Tell me how an orange and a banana are alike”*. If the subject answers in a concrete manner, then say only one additional time: *“Tell me another way in which those items are alike”*. If the subject does not give the appropriate response (*fruit*), say, *“Yes, and they are also both fruit.”* Do not give any additional instructions or clarification. After the practice trial, say: *“Now, tell me how a train and a bicycle are alike”*. Following the response, administer the second trial, saying: *“Now tell me how a scale and a watch are alike”*. Do not give any additional instructions or prompts.

### **10. Delayed recall:**

The examiner gives the following instruction: *“I read some words to you earlier, which I asked you to remember. Tell me as many of those words as you can remember.”* Make a check mark (✓) for each of the words correctly recalled spontaneously without any cues, in the allocated space.

Optional: Following the delayed free recall trial, prompt the subject with the semantic category cue provided below for any word not recalled. Make a check mark ( √ ) in the allocated space if the subject remembered the word with the help of a category or multiple-choice cue. Prompt all non-recalled words in this manner. If the subject does not recall the word after the category cue, give him/her a multiple-choice trial, using the following example instruction, “Which of the following words do you think it was, EYE, FACE, or HAND?”

Use the following category and/or multiple-choice cues for each word, when appropriate:

	<b>Category Cue</b>	<b>Multiple choice</b>
EYES	Part of the body	Nose, Eyes, Ear
SAREE	Type of clothing	Dupatta/Stole, Saree, Lungi
TEMPLE	Type of building	Temple, School, Hospital
ROSE	Type of flower	Jasmine, Rose, Marigold
BLUE	Type of color	White, Red, Blue

### **11. Orientation:**

Administration: The examiner gives the following instructions: “Tell me the date today”. If the subject does not give a complete answer, then prompt accordingly by saying: “Tell me the [year, month, exact date, and day of the week].” Then say: “Now, tell me the name of this place, and which city it is in.”

### **Scoring:**

#### **1. Alternating Trail Making:**

Scoring: Allocate one point if the subject successfully draws the following pattern:

1–A- 2- B- 3- C- 4- D- 5- E, without drawing any lines that cross. Any error that is not immediately self-corrected earns a score of 0.

## **2. Visuo-constructional Skills (Cube):**

Scoring: One point is allocated for a correctly executed drawing.

- Drawing must be three-dimensional
- All lines are drawn
- No line is added
- Lines are relatively parallel and their length is similar (rectangular prisms are accepted)

A point is not assigned if any of the above-criteria are not met. Orientation and size do not matter.

## **3. Visuo-constructional Skills (Clock):**

Scoring: One point is allocated for each of the following three criteria:

1. Contour (1 pt.): the clock face must be a circle with only minor distortion acceptable (e.g., slight imperfection on closing the circle);
2. Numbers (1 pt.): all clock numbers must be present with no additional numbers; numbers must be in the correct order and placed in the approximate quadrants on the clock face; Roman numerals are acceptable; numbers can be placed outside the circle contour;
3. Hands (1 pt.): there must be two hands jointly indicating the correct time; the hour hand must be clearly shorter than the minute hand; hands must be centred within the clock face with their junction close to the clock centre.

A point is not assigned for a given element if any of the above-criteria are not met. Shape of the clock does not matter, either square, rectangle or circle shape is acceptable.

## **4. Naming:**

Scoring: One point each is given for the following responses: (1) lion (2) rhinoceros or rhino (3) camel or dromedary.

## **5. Memory**

Scoring: No points are given for Trials One and Two.

## **6. Attention:**

Scoring: Allocate one point for each sequence correctly repeated, (*N.B.*: the correct response for the backwards trial is 2-4-7).

## **Vigilance:**

Scoring: Give one point if there is zero to one error (an error is a tap on a wrong letter or a failure to tap on letter A).

## **Serial 7s:**

Scoring: This item is scored out of 3 points. Give no (0) points for no correct subtractions, 1 point for one correct subtraction, 2 points for two-to-three correct subtractions, and 3 points for four or five correct subtractions. Count each correct subtraction of 7 beginning at 100. Each subtraction is evaluated independently; that is, if the participant responds with an incorrect number but continues to correctly subtract 7 from it, give a point for each correct subtraction. For example, a participant may respond “92 – 85 – 78 – 71 – 64” where the “92” is incorrect, but all subsequent numbers are subtracted correctly. This is one error and the item would be given a score of 3.

## **Sentence repetition:**

Scoring: Allocate 1 point for each sentence correctly repeated. Repetition must be exact. Be alert for errors that are omissions (e.g., omitting "only", "always") and substitutions/additions (e.g., "John is the one who helped today;" substituting "hides" for "hid", altering plurals, etc.).

## **7. Verbal fluency:**

Scoring: Allocate one point if the subject generates 11 words or more in 60 sec. Record the subject's response in the bottom or side margins

## **8. Abstraction:**

Scoring: Only the last two item pairs are scored. Give 1 point to each item pair correctly answered. The following responses are acceptable:

Train-bicycle = means of transportation, means of travelling, you take trips in both;

Scale-watch = measuring instruments, used to measure.

The following responses are not acceptable: Train-bicycle = they have wheels; Scale- watch=they have numbers.

**9. Delayed recall:**

Scoring: Allocate 1 point for each word recalled freely without any cues.

**No points are allocated for words recalled with a cue.** A cue is used for clinical information purposes only and can give the test interpreter additional information about the type of memory disorder. For memory deficits due to retrieval failures, performance can be improved with a cue. For memory deficits due to encoding failures, performance does not improve with a cue.

**10. Orientation:**

Scoring: Give one point for each item correctly answered. The subject must tell the exact date and the exact place (name of hospital, clinic, office). No points are allocated if subject makes an error of one day for the day and date.

**TOTAL SCORE:**

Sum all sub scores listed on the right-hand side. Add one point for an individual who has 12 years or fewer of formal education, for a possible maximum of 30 points. A final total score of 26 and above is considered normal.

**Duration:**

The test takes 5-10 minutes to administer.

VISUOSPATIAL / EXECUTIVE		Copy cube		Draw CLOCK (Ten past eleven) (3 points)		POINTS			
				<input type="checkbox"/> Contour <input type="checkbox"/> Numbers <input type="checkbox"/> Hands		<input type="checkbox"/> /5			
NAMING									
						<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> /3			
MEMORY		Read list of words, subject must repeat them. Do 2 trials, even if 1 <sup>st</sup> trial is successful. Do a recall after 5 minutes.		EYE	SAREE	TEMPLE	ROSE	BLUE	No points
		1 <sup>st</sup> trial							
		2 <sup>nd</sup> trial							
ATTENTION		Read list of digits (1 digit/sec). Subject has to repeat them in the forward order		[ ] 2 1 8 5 4				___/2	
		Subject has to repeat them in the backward order		[ ] 7 4 2					
		Read list of letters. The subject must tap with his hand at each letter A. No points if ≥ 2 errors		[ ] F B A C M N A A J K L B A F A K D E A A A J A M O F A A B				___/1	
		Serial 7 subtraction starting at 100		[ ] 93	[ ] 86	[ ] 79	[ ] 72	[ ] 65	___/3
		4 or 5 correct subtractions: 3 pts, 2 or 3 correct: 2 pts, 1 correct: 1 pt, 0 correct: 0 pt							
LANGUAGE		Repeat: I only know that Raju is the one to help today. [ ]						___/2	
		The cat always hid under the sofa when the dogs were in the room. [ ]							
ABSTRACTION		Maximum number of words in one minute that begin with the letter P [ ] _____ (N ≥ 11 words)						___/1	
DELAIED RECALL		Similarity between e.g. banana - orange = fruit [ ] train - bicycle [ ] watch - scale						___/2	
		Has to recall words WITH NO CUE		EYE	SAREE	TEMPLE	ROSE	BLUE	Points for UNCUED recall only
		[ ]		[ ]	[ ]	[ ]	[ ]	[ ]	
Optional		Category cue							
		Multiple choice cue							
ORIENTATION		[ ] Date	[ ] Month	[ ] Year	[ ] Day	[ ] Place	[ ] City	___/6	

# **TESTS OF ATTENTION AND EXECUTIVE FUNCTION**

## **TRAIL MAKING TEST B & W**

The TMT-B&W is a measure of attention, speed, and mental flexibility. It also tests spatial organization, visual pursuits, recall, and recognition. TMT A requires the individual to draw lines to connect 25 encircled numbers distributed on a page. It tests visual scanning, numeric sequencing, and visuomotor speed. TMT B is similar except the person must alternate between numbers and circles in two colors (black and white). This is believed to be more difficult and takes longer to complete. TMT B tests cognitive demands including visual motor and visual spatial abilities and mental flexibility. Both sections are timed, and the score represents the amount of time required to complete the task.

### **Instructions:**

Both parts of the Trail Making Test consist of 25 circles distributed over a sheet of paper. In Part A, the circles are numbered 1 – 25, and the patient should draw lines to connect the numbers in ascending order (irrespective of the color of the circle). In Part B, the circles include numbers (1 – 25) in both black and white circles. In Part B, the patient draws lines to connect the encircled numbers in an ascending pattern, similar to Part A but with the added task of alternating between black and white encircled numbers (i.e., 1 in white circle-2 in black circle-3 in white circle-4 in black circle-5 in white circle-6 in black circle, etc.).

**Part A:** Tell the participant: *“Please connect the circles (irrespective of the color of the circle) in ascending order, as quickly as possible, without lifting the pen or pencil from the paper”.*

**Part B:** Tell the participant: *“Please connect the circles in ascending pattern alternating between white and black circles, as quickly as possible, without lifting the pen or pencil from the paper.”*

Time the patient as he/she connects the "trail." If the patient makes an error, point it out immediately and allow the patient to correct it. Errors affect the patient's score only in that the correction of errors is included in the completion time for the task. It is unnecessary to continue the test if the patient has not completed both parts after five minutes has elapsed.

Materials required include the TMT-B&W Part A and B practice and test sheets, pen/pencil and stopwatch.

**Step 1:** Give the patient a copy of the TMT-B&W Part A worksheet and a pen or pencil.

**Step 2:** Demonstrate the test to the patient using the sample sheet (TMT-B&W-Part A – *SAMPLE*).

**Step 3:** Time the patient as he or she follows the “trail” made by the numbers on the test.

**Step 4:** Record the time using a stopwatch.

**Step 5:** Repeat the procedure for TMT-B&W- Part B.

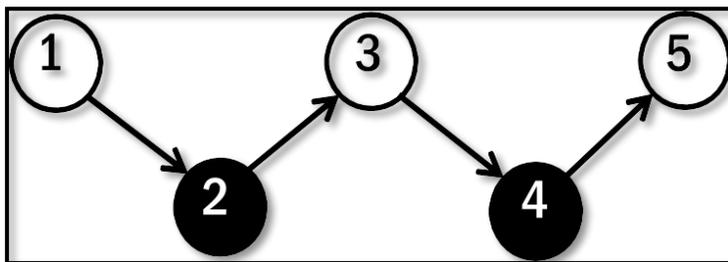
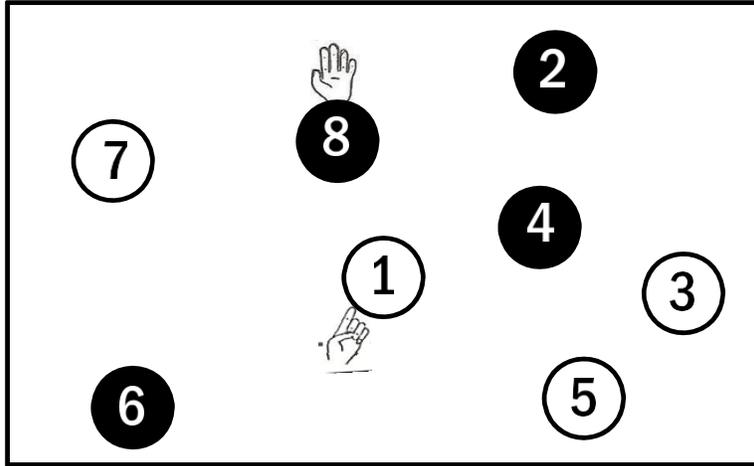
**Duration:**

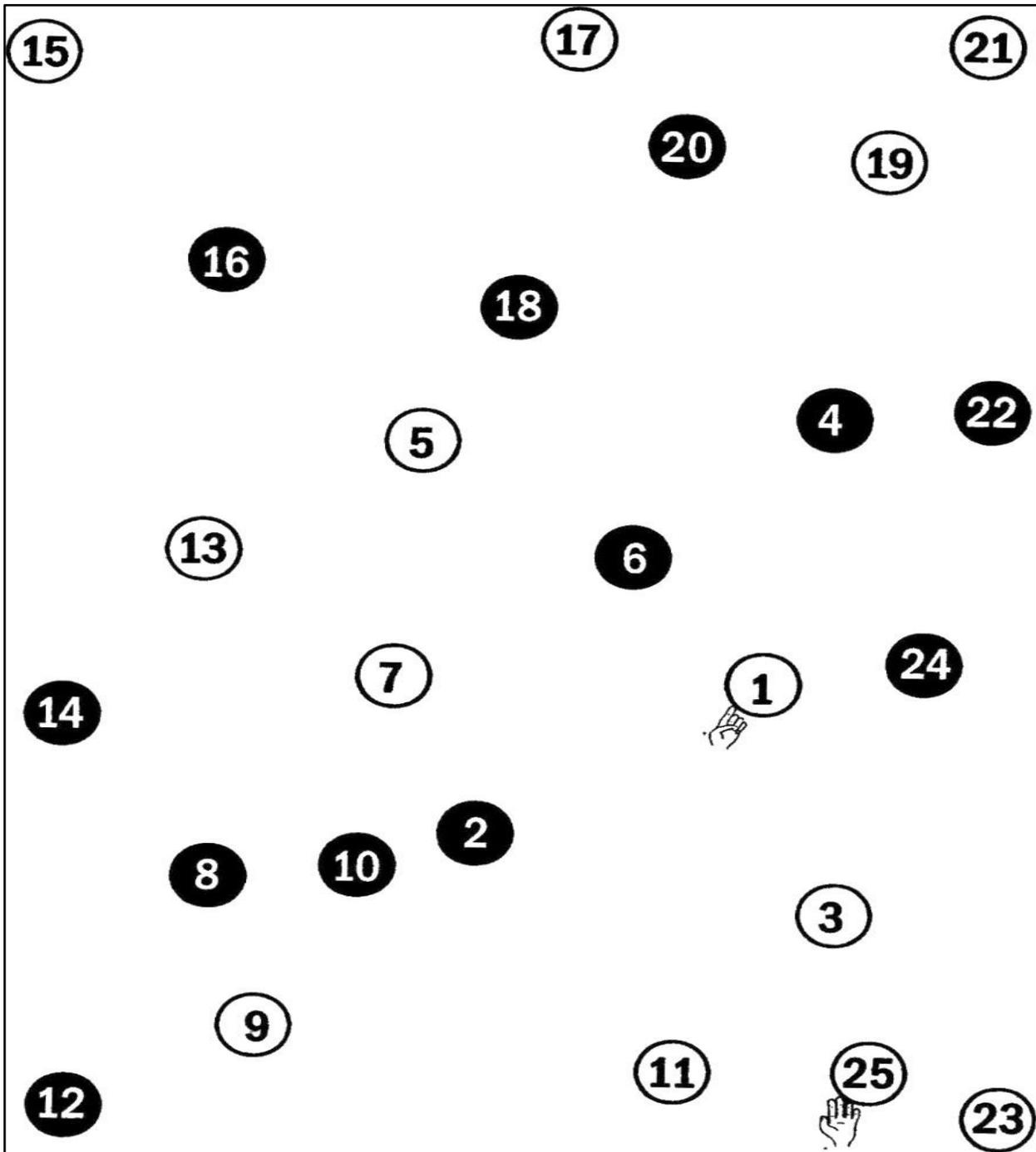
The test takes 5-10 minutes to administer.

# Trail Making Test - Black & White

## Part A

### Exercise

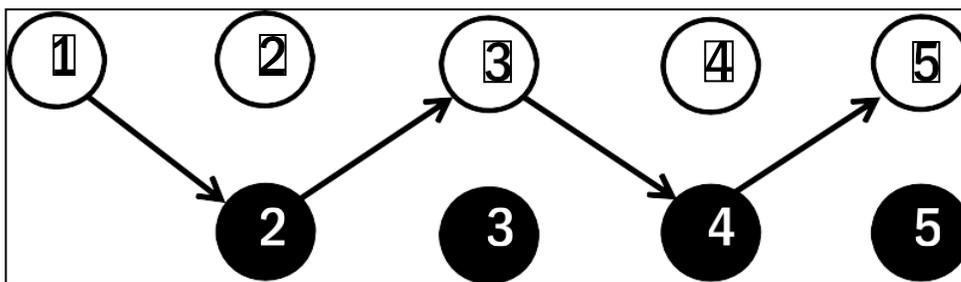
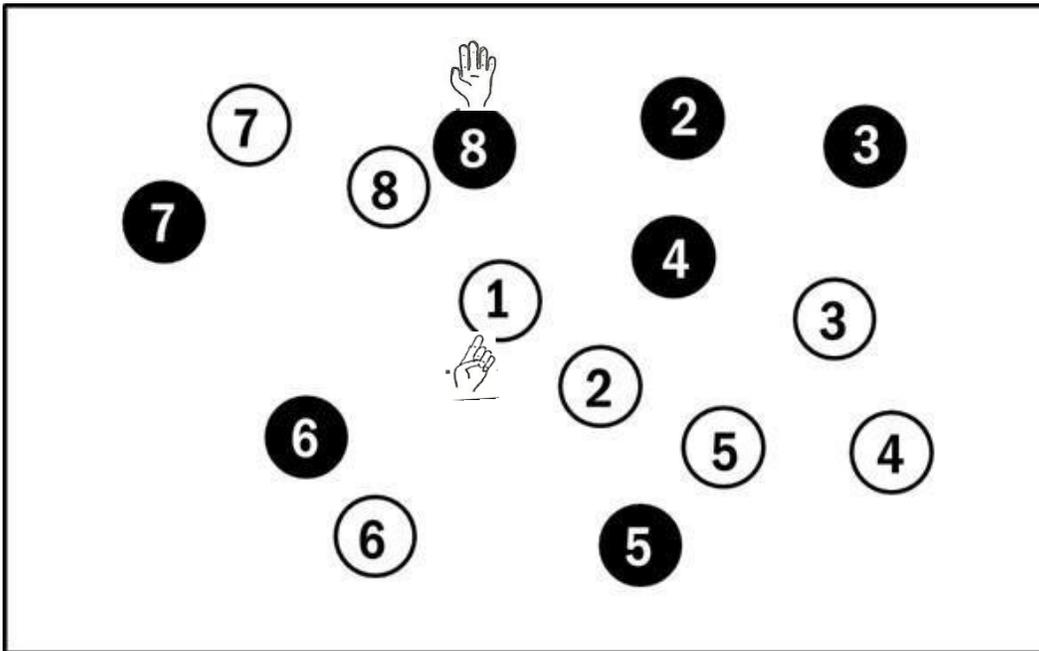


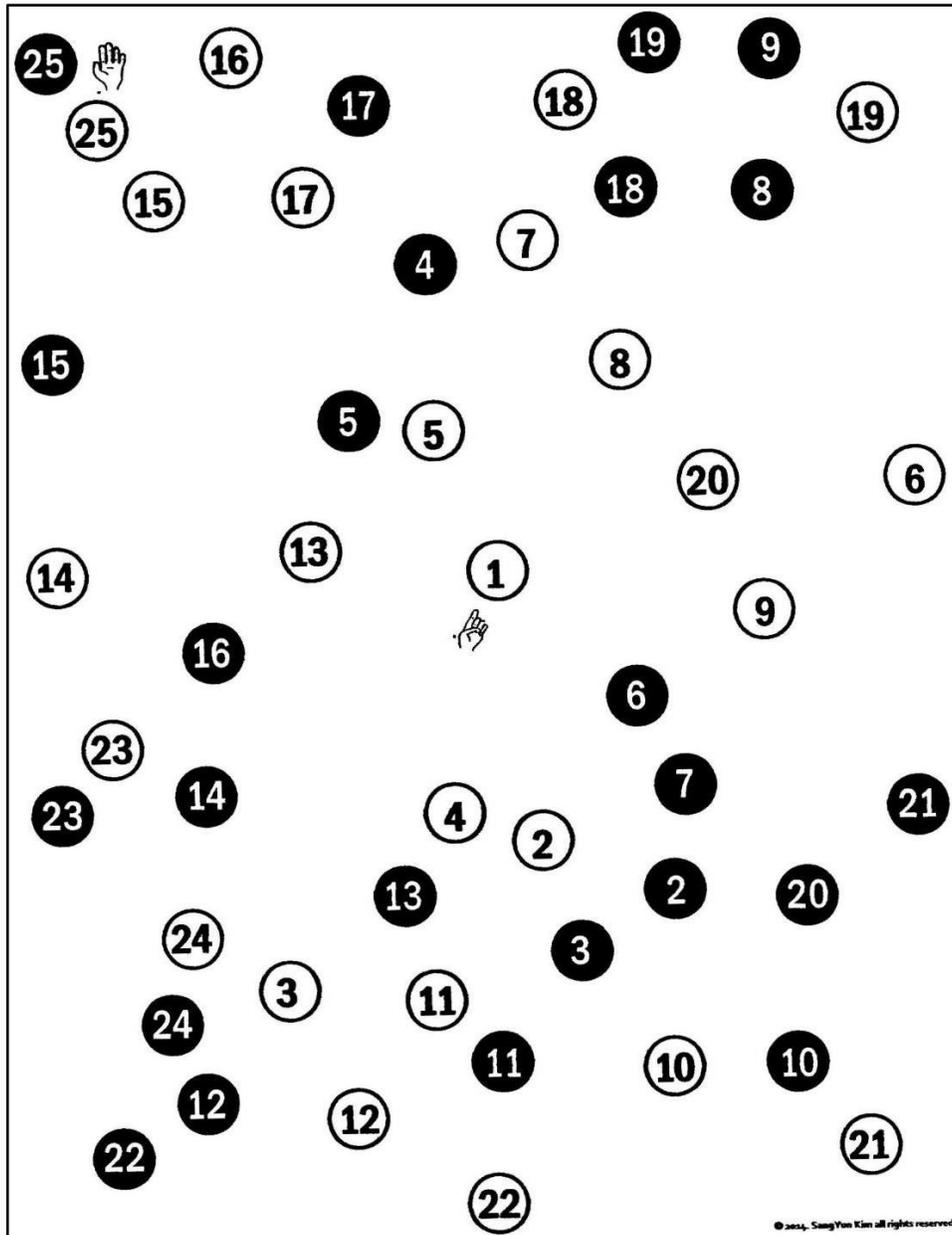


Trail Making Test - Black & White

Part B

Exercise





**Time limitation: 5 minutes for each test (A & B)**

	<b>TMT - B&amp;W Type A</b>	<b>TMT - B&amp;W Type B</b>
<b>Completion time</b>	<b>sec</b>	<b>sec</b>
<b>Number of errors</b>		

**Scoring:**

Results for both TMT-B&W A and B are reported as the number of seconds required to complete the task; therefore, higher scores reveal greater impairment.

**Average Deficient Rule of Thumb**

**Trail A:** 29 seconds > 78 seconds Most in 90 seconds

**Trail B:** 75 seconds > 273 seconds Most in 3 minutes

**Duration:**

The test takes 5-10 minutes to administer.

## **CATEGORY FLUENCY**

In the verbal or category fluency task, the subject generates words that belong to a semantic category. For example, the Animal names test (Lezak, 1995) requires the subjects to generate names of animals for one minute.

### **Administration:**

For each of the fluency tasks, the subject is asked to generate the names of as many items in that category as possible in one minute.

There are 3 fluency tasks that will be administered. The order in which the 3 tasks are administered should be changed for every subject. Also, the language of testing should be specified to the subject and the tester should give the instructions in the same language.

### **Instructions:**

#### **Animals:**

**Administration:** Tell the participant: *"Name as many animals as possible. It can begin with any letter. Do not repeat names that you have already given once. You will be given one minute."*

**Scoring:** Record the responses and the total number of animals that the participant generates. Then count the total number of correct words, which do not include higher order categories when specific exemplars are given (e.g., "fish" followed by "salmon" and "trout" --- total = 3; correct = 2). All types of animals are accepted, including insects, humans, prehistoric, extinct as well as mythical creatures (e.g., unicorn).

Total score will be only correct responses in the target language. However, other language correct responses will also be scored separately (marked as OL in the data entry sheet for correct answer). Borrowed words, which are part of the target language, will be scored as correct response (e.g., "giraffe").

## **Vegetables:**

**Administration:** Tell the participant: *"Name as many vegetables as possible. It can begin with any letter. Please do not say names of fruits. Do not repeat names that you have already given once. You will be given one minute."*

**Scoring:** Record the responses and the total number of vegetables that the participant generates. Then, count the total number of correct words, which do not include higher order categories when specific exemplars are given (e.g., "leafy vegetables" followed by "spinach" and "lettuce" --- total = 3; correct = 2). All types of vegetables are accepted.

Total score will be only correct responses in the target language. However, other language correct responses will also be scored separately (marked as OL in the data entry sheet for correct answer). Borrowed words, which are part of the target language, will be scored as correct response (e.g., "beans")

## **Food Items:**

**Administration:** Tell the participant: *"Name as many food items as possible. It can begin with any letter. Please do not say the names of fruits and vegetables. Do not repeat names that you have already given once. You will be given one minute."*

**Scoring:** Record the responses and the total number of food items that the participant generates. Then, count the total number of correct words, which do not include higher order categories when specific exemplars are given (e.g., "pastry" followed by "chocolate pastry" and "black forest pastry" --- total = 3; correct = 2). All types of food items are accepted.

Total score will be only correct responses in the target language. However, other language correct responses will also be scored separately (marked as OL in the data entry sheet for correct answer). Borrowed words, which are part of the target language, will be scored as correct response (e.g., "cake).

Scoring Sheet

**CATEGORY FLUENCY (Test Sheet)**

SL.NO	ANIMALS	VEGETABLES	FOOD ITEMS
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			
25			
26			
27			
28			
29			
30			
TOTAL			

**Scoring:**

Total Correct Response in native language (NL) + Total Correct Response in other language (OL)

$$\text{Total} = \text{NL} + \text{OL} =$$

**Scoring:**

The number of correctly named items generated forms the score.

The number of correctly named items generated forms the score. Also, for all three categories, there will be 3 types of scoring:

1. For correctly named items in the language being tested
2. For correctly named items in another language (coded as other language (OL) in the data entry sheet)
3. For errors (repetition, perseveration, super---ordinate category errors)

There will be 2 sets of total scores:

1. One set of scores will only be the correct responses in the language being tested.
2. Another set of scores will be a composite of correct responses in target language and other languages.

**Errors:**

For qualitative analyses, will need to make a detailed note of the errors made by the subject, be it semantic category error, perseverative errors, repetition errors, super ordinate category error etc. These have been coded in the data entry template as follows:

Repetition Error = R

Perseverative Error = P

Semantic Category Error = will be coded as “0”

Super-ordinate category Error = S

## **PHONEMIC FLUENCY**

**Administration:** The examiner gives the following instruction: *Tell me as many words as you can think of that begin with a certain letter of the alphabet that I will tell you in a moment. You can say any kind of word you want, except for proper nouns (like Rama or Rajasthan), numbers, or words that begin with the same sound but have a different suffix, for example, love, lover, loving. I will tell you to stop after one minute. Are you ready?*  
[Pause]

- *“Now, tell me as many words as you can think of that begin with the letter Pa. [time for 60 sec].  
Stop.”*
- *“Now, tell me as many words as you can think of that begin with the letter Ka. [time for 60 sec].  
Stop.”*
- *“Now, tell me as many words as you can think of that begin with the letter Ma. [time for 60 sec].  
Stop.”*

### **EXAMPLE:**

Sound “**DA**”

Day, Dish, Duke, Dinner, Date, Duck, Delta, Delay, Daisy

Scoring Sheet

**PHONEMIC FLUENCY (Test Sheet)**

<b>SL.NO</b>	<b>Pa</b>	<b>Ka</b>	<b>Ma</b>
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			
25			
26			
27			
28			
29			
30			
<b>TOTAL</b>			

**Scoring:**

Total Correct Response in native language (NL)

Total Correct Response in other language (OL)

$\text{Total} = \text{NL} + \text{OL} =$
--

**Scoring:**

The number of correctly named items generated forms the score.

The number of correctly named items generated forms the score. Also, for all three categories, there will be 3 types of scoring:

1. For correctly named items in the language being tested
2. For correctly named items in another language (coded as other language (OL) in the data entry sheet)
3. For errors (repetition, perseveration, super-ordinate category errors) There will be 2 sets of total scores:
  1. One set of scores will only be the correct responses in the language being tested.
  2. Another set of scores will be a composite of correct responses in target language and other languages.

**Errors:**

For qualitative analyses, will need to make a detailed note of the errors made by the subject, be it, perseverative errors, repetition errors, super ordinate category error etc. These have been coded in the data entry template as follows:

Repetition Error = R

Perseverative Error = P

Super-ordinate category error = S

# **TESTS OF EPISODIC MEMORY**

## **VERBAL LEARNING TEST (from Kolkata Cognitive Screening Battery)**

Verbal Learning test is sub-test of the Kolkata Cognitive Screening Battery. The aim of Verbal Learning test is to measure the immediate and delayed recall of the participant on a list of 10 words. The immediate recall is done immediately, and the delayed recall is measured after distraction task is administered in between. The distraction task should be of 15-20 minutes.

### **Administration & Scoring:**

#### **Word List Memory Task**

*“I will read 10 words from this paper. Listen to them carefully and repeat them in any order after I finished my reading. Remember I will ask you to recall these words later.”* Same instructions repeated for the 2nd and 3rd trial.

**Trial 1:** Butter, Arm, Corner, Letter, Queen, Ticket, Grass, Stone, Book, Stick

**Trial 2:** Ticket, Book, Butter, Corner, Stone, Arm, Queen, Letter, Stick, Grass

**Trial 3:** Queen, Grass, Arm, Book, Stick, Corner, Butter, Stone, Ticket, Letter One point for each word correctly recalled. Maximum score: 30

#### **Delayed Word List Memory Task**

*“Few minutes ago, I read out a list of 10 words from this paper. Tell me those words again.”*

One point for each correct word recalled. Maximum score: 10

#### **Delayed Recognition Word Task**

*“Few minutes ago, I read out 20 words from this paper. Tell me whether “tree” was there on the list.”*- If the patient gives correct response, say “correct” or if he/she gives “incorrect” response, then say this is incorrect and continue for next word.

**(Stimuli list:** Butter, Temple, Arm, Tea, Key, Corner, Five, Letter, Hotel, Mountain, Queen, Book, Shoe, Stick, Village, Thread, Ticket, Soldier, Grass, Stone)

One point for each word recognized. Maximum score: 20

### **Note to the Tester:**

Correction/clarification when the instructions are being given is allowed. No correction is allowed after the subject has responded and no feedback should be given to the subject.

If the subject is hearing impaired, repeating each word is allowed until the subject understands it.

### **Errors:**

**Intrusion errors:** including words that are not originally in the list

**Repetitions:** of the same words in the list

**Perseverations:** repetitive response pattern (yes, yes, yes, no, no, no)

### **Scoring:**

Number of words correctly repeated in each of the 3 trials is scored. Intrusions, perseverations and repetitions are coded separately in the error column in the data entry sheet. The responses of the subject should be noted verbatim during test administration, along with errors.

### **Delayed Recall:**

Number of words correctly recalled is scored. Intrusions, perseverations and repetitions are coded separately in the error column in the data entry sheet. The responses of the subject should be noted verbatim during test administration, along with errors.

### **Recognition:**

The subjects' responses will be yes/no. The test administrator will code the response as correct or incorrect based on whether the response is accurate or not in the column next to the word. This is during the test administration.

**Explanatory Note:** In the recognition test: The false positives (saying it is correct when it is not) are the complimentary part of the true negatives, and the false negative (saying something is false when it is not) complements the true positives. Therefore, the score in the true positive + false negative = 10

True negative + false positive = 10

**Total Learning and Delayed Recall**

TRIAL 1 (T1)		TRIAL 2 (T2)		TRIAL 3 (T3)		DELAYED RECALL
STIMULUS	RESPONSE	STIMULUS	RESPONSE	STIMULUS	RESPONSE	
BUTTER		TICKET		QUEEN		
ARM		BOOK		GRASS		
CORNER		BUTTER		ARM		
LETTER		CORNER		BOOK		
QUEEN		STONE		STICK		
TICKET		ARM		CORNER		
GRASS		QUEEN		BUTTER		
STONE		LETTER		STONE		
BOOK		STICK		TICKET		
SITCK		GRASS		LETTER		

**Delayed Recognition:**

Words	Recognition	Words	Recognition
<b><u>BUTTER</u></b>		<b><u>QUEEN</u></b>	
TEMPLE		<b><u>BOOK</u></b>	
<b><u>ARM</u></b>		SHOE	
TEA		<b><u>STICK</u></b>	
KEY		VILLAGE	
<b><u>CORNER</u></b>		THREAD	
FIVE		<b><u>TICKET</u></b>	
<b><u>LETTER</u></b>		SOLDIER	
HOTEL		<b><u>GRASS</u></b>	
MOUNTAIN		<b><u>STONE</u></b>	

TL = Total Learning (TL) = T1+T2+T3

LOT = Learning Over Trials (LOT) = TL-3T1

DR = Delayed Recall (DR) = Obtained score/10

Delayed Recognition = Obtained score/20

## **TNI-93**

TNI-93 (French acronym of “Test desn Neuf Images du 93”, i.e., Nine Images test of the district of Seine-Saint-Denis) is a short, easy to administer test of episodic memory. It does not require proficiency in writing or reading any language and therefore, can be effectively administered to illiterate and low educated populations. The test was developed to assist in neuropsychological testing of dementia with illiterate and low educated populations.

### **Administration:**

Participants complete a naming task based on the semantic category given by the examiner and are asked to remember the name and the location of the 9 pictures (a duck, a bike, a guitar, a carrot, an ear, a chair, a grape, a shoe, and a fork) shown to them. For immediate recall, pictures are masked and the participants are asked to name the pictures. For the forgotten pictures, a cued recall process is initiated in which the participants are given semantic cues to assist in recall. After this process, if not all items can be recalled, then the images are displayed again with the same encoding cues used before. An interference task of counting backward by 3 from 40 is introduced for 20 seconds. The participants are then asked to name as many pictures as they can within 2 minutes. For the forgotten items, the cued recall process is initiated again. For Spatial Recall, the participants are shown the images one by one and asked to locate it on a blank board. Errors are noted for each step. The duration of the test is about 10 minutes.

**PICTURE NAMING:**

“I will show a board with 9 pictures. You should try and memorize the name and the location of these images on the board, as I will ask you about these pictures just now. We will learn them together one by one, taking our time learning them.”

Show the board with the 9 images now:

<b>Duck</b>	<b>Bicycle</b>	<b>Tabla</b>
<b>Carrot</b>	<b>Ear</b>	<b>Chair</b>
<b>Grapes</b>	<b>Shoe</b>	<b>Spoon</b>

Naming: \_\_\_\_\_/9

“Look at the sheet in front of you. Can you please tell me what is the name of: the animal ( ), the mode of transport ( ), the musical instrument ( ), the vegetable ( ), the body part ( ), the piece of furniture ( ), the fruit ( ), the clothing item ( ), the kitchen utensil ( ).”

Make a note of the errors: \_\_\_\_\_

**IMMEDIATE RECALL:**

Cover the board fully so that the entire with the 9 images are fully covered.

“Look at the sheet in front of you. Can you please tell me what was the name of: the animal ( ), the mode of transport ( the ), the musical instrument ( ), the vegetable ( ), the body part ( ), piece of furniture ( ), the fruit ( ), the clothing item ( ), the kitchen utensil ( ).”

Immediate Recall: \_\_\_\_\_/9

Intrusions: \_\_\_\_\_

Make a note of the intrusions: \_\_\_\_\_

In case of inability to recall one or many of the items, show the board, ask the name of the missed items (i.e., picture naming), then cover the board, and ask the name of the missed items (i.e., cued recall).

No. of trials: \_\_\_\_\_

Make note of the number of trials for registering correctly the 9 items.

Calculation: \_\_\_\_\_/5

**INTERFERENCE TEST (20 seconds)**

“Count backwards from 40 taking away 3 from it. Keep doing that until I ask you to stop”:  
37 34 31 28 25

**FREE RECALL:**

“Name the pictures that you remember” (Duration: 2 minutes)

<b>Duck</b>	<b>Bicycle</b>	<b>Tabla</b>
<b>Carrot</b>	<b>Ear</b>	<b>Chair</b>
<b>Grapes</b>	<b>Shoe</b>	<b>Spoon</b>

Free Recall: \_\_\_\_\_/9

Make note of the intrusions: \_\_\_\_\_

Intrusions: \_\_\_\_\_

**CUED RECALL (Only for the non--recalled items)**

“Let me help you. What is the name of: the animal, the mode of transport, the musical instrument, the vegetable, the body part, the piece of furniture, the fruit, the clothing item, the kitchen utensil?”

<b>Duck</b>	<b>Bicycle</b>	<b>Tabla</b>
<b>Carrot</b>	<b>Ear</b>	<b>Chair</b>
<b>Grapes</b>	<b>Shoe</b>	<b>Spoon</b>

Make note of the intrusions: \_\_\_\_\_

Cued Recall |\_\_\_\_\_|

**Total Recall = Free Recall + Cued Recall Total**  
**Intrusions = Sum of all intrusions**

Intrusions |\_\_\_\_\_|

**SPATIAL RECALL:**

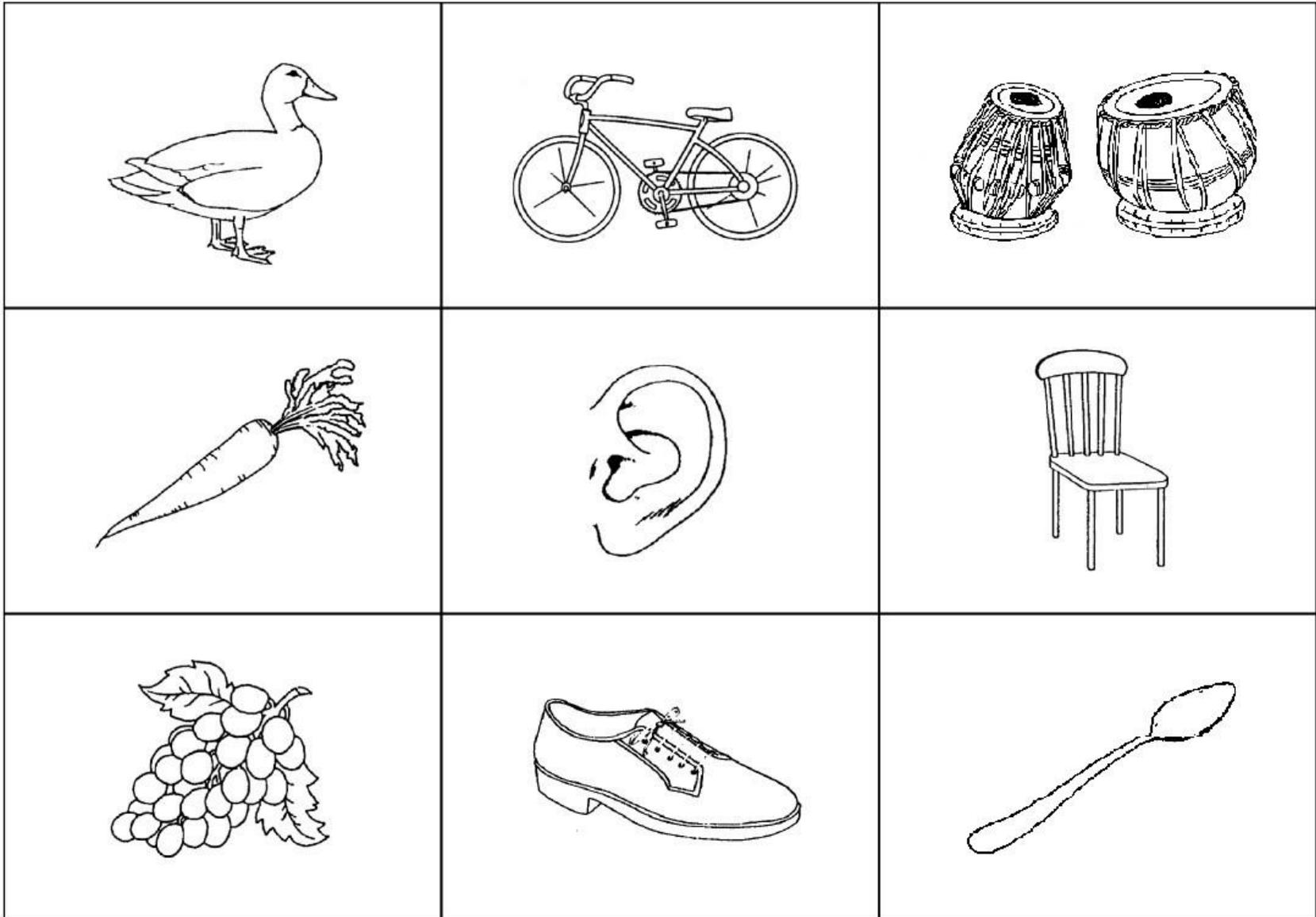
Show the blank board. Show the images one by one in the following order:  
**Chair Shoe Duck Carrot Tabla Bicycle Spoon Ear Grapes**

For every image being shown, ask the subject, “Where would you find this image on the board?”

<b>Chair</b>  _____  (6)	<b>Shoe</b>  _____  (8)	<b>Duck</b>  _____  (1)
<b>Carrot</b>  _____  (4)	<b>Tabla</b>  _____  (3)	<b>Bicycle</b>  _____  (2)
<b>Spoon</b>  _____  (9)	<b>Ear</b>  _____  (5)	<b>Grapes</b>  _____  (7)

Total Recall |\_\_\_\_\_|

Total Intrusions |\_\_\_\_\_|



# **TESTS OF LANGUAGE**

## **PICTURE NAMING TEST**

### **Administration**

Subjects are asked to identify each item by telling them the first name that came to their mind on seeing the item on the stimulus card. All instructions will be provided in the testing language (either Indian English, Hindi, Bengali, Telugu, Kannada or Malayalam), and as part of the initial instructions, all the participants will be asked to generate names in the testing language only.

The test administrator shows the person each of the pictures, one at a time in the pre-determined order. The person is given a maximum of 10 seconds to say what the drawing depicts. If the subject is unable to name the picture or makes an error in naming the picture in maximum of 10 seconds, then a category cue is provided. If after the maximum of 10 seconds after the category cue being provided, the subject is still unable to name or makes an error, then a phonemic cue is provided. If after a maximum of 10 seconds after the phonemic cue, the subject still is unable to name or makes an error, then the tester moves onto the next picture.

Maximum time allowed for each picture = 30 seconds.

### **Instructions**

*“I will now be showing you some pictures. You have to look at each of these pictures and tell me the name of each picture. Some of these pictures will have many different names but should tell me the most common name. If you are not sure about the name just guess. So, shall we begin? Now tell me the name of this picture.”*

Therefore, for each picture,

1. Free naming of the picture.
2. After a maximum of 10 seconds delay, if the subject is unable to name the picture or makes an error in naming provide semantic cue.
3. After another maximum of 10 seconds delay, if the subject is still unable to name the picture, then provide a phonological cue.

Maximum time allowed per picture = 30 seconds Repeat this process for all the pictures in the list.

## **Scoring**

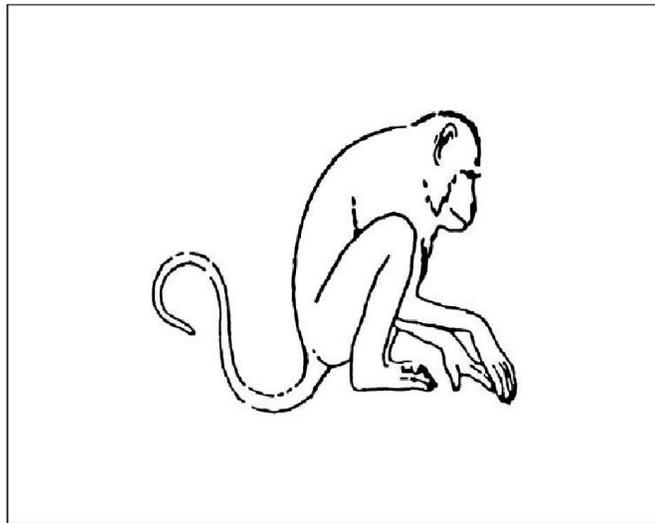
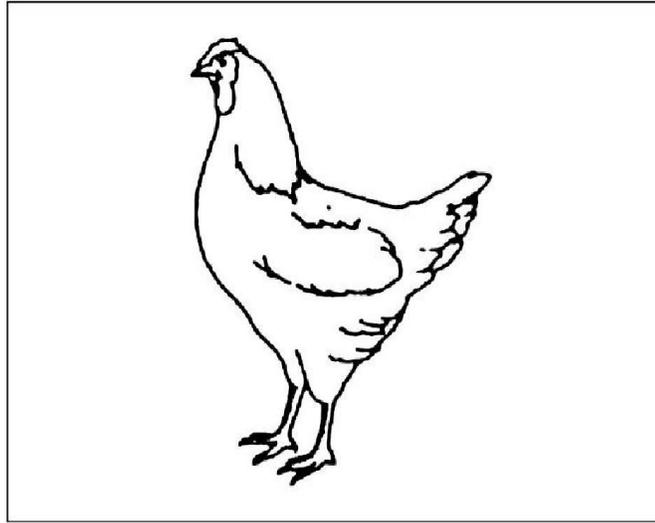
The responses are coded as follows in the data entry sheet:

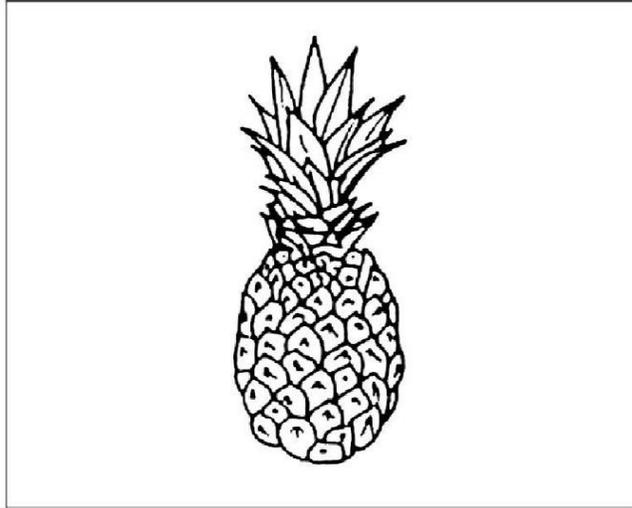
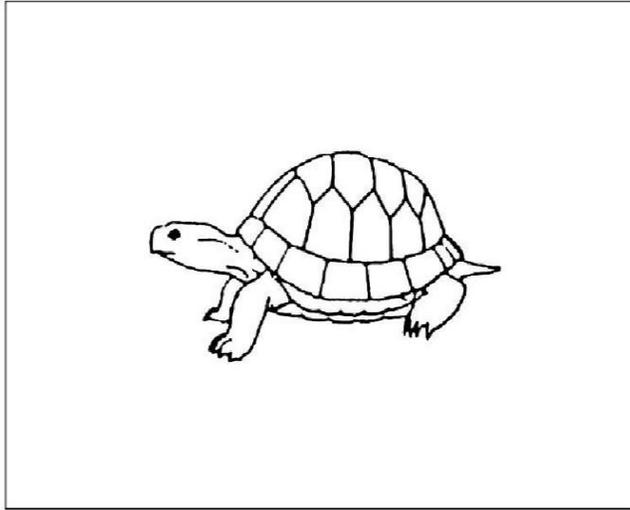
1. Correct response in testing language = 3 points
2. Correct response in other languages = OL3
3. Response after semantic cue = 2 points
4. Correct response after semantic cue in other languages = OL2
5. Response after phonemic cue = 1 point
6. Response after phonemic cue in other language = OL1

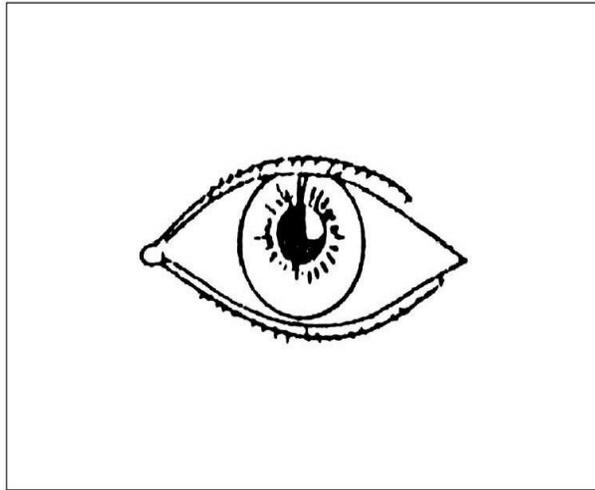
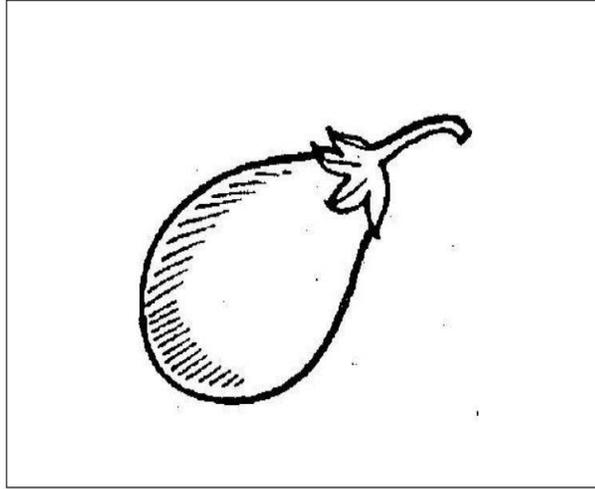
## **Error responses:**

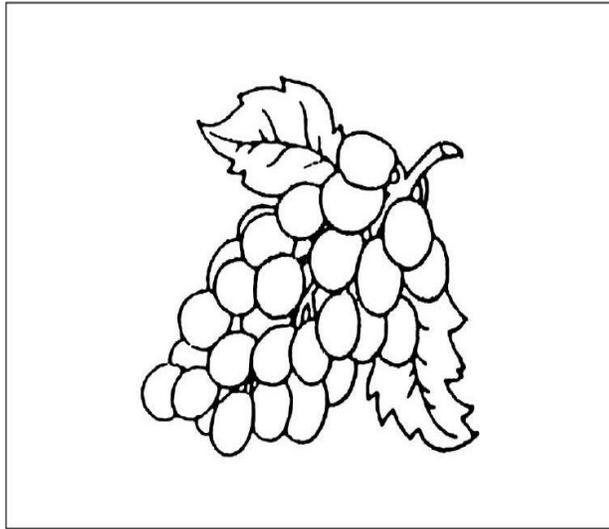
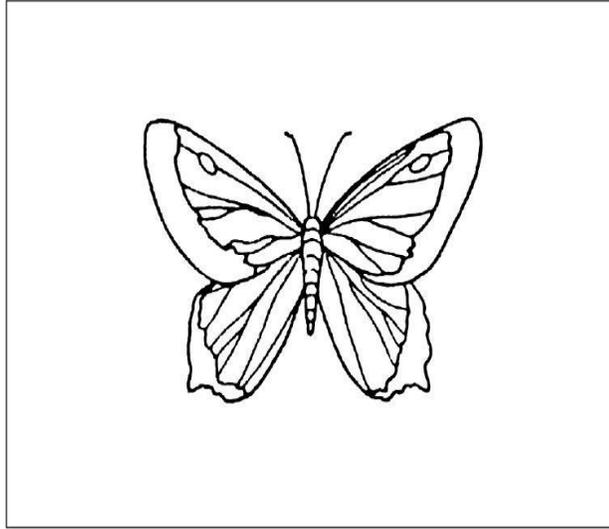
The errors will be coded as follows in the data entry sheet.

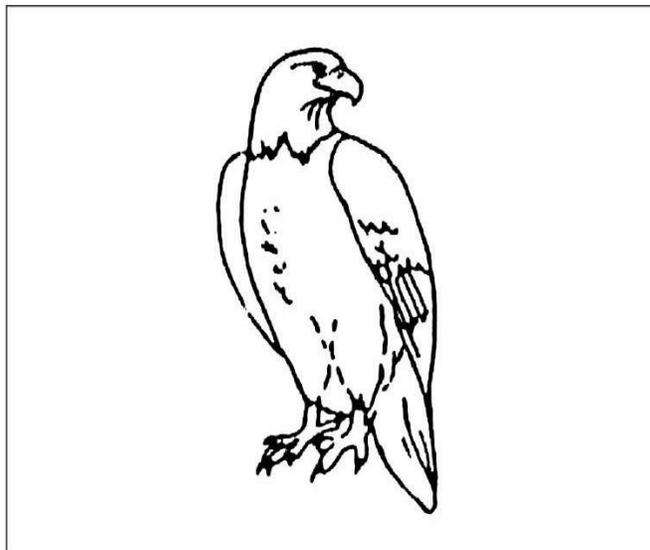
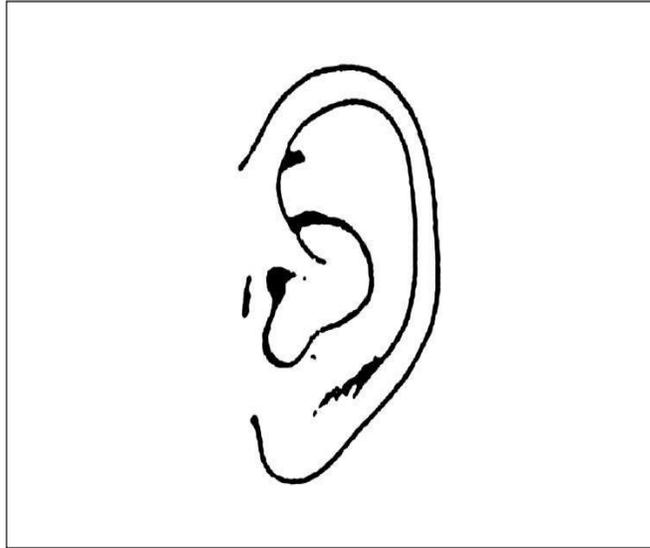
1. Error/incorrect responses will be coded as “ER” for items in free naming and for naming with semantic/category cue.
2. Incorrect response (after both the cues are given) = will be coded as “0”
3. If the subject is unable to name the item after all the cues then it is coded as “No responses” or “Don’t Know” = NR/DK
4. Missing data = Missing

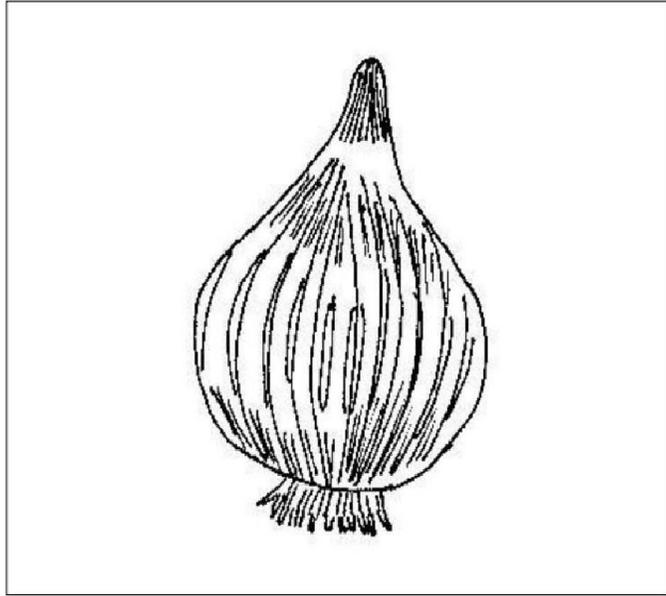


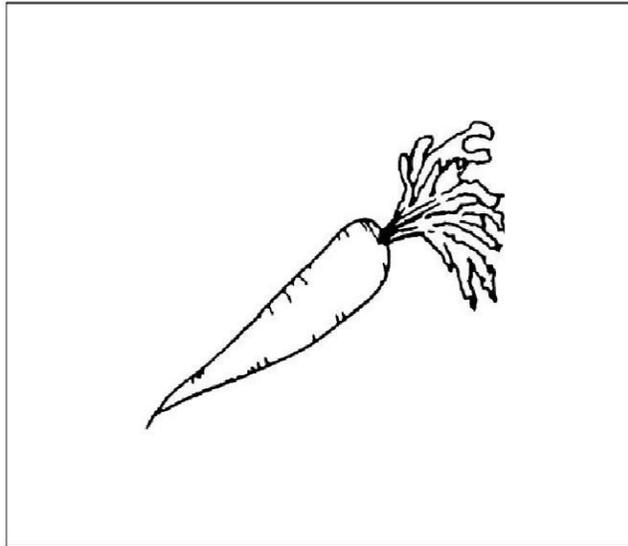
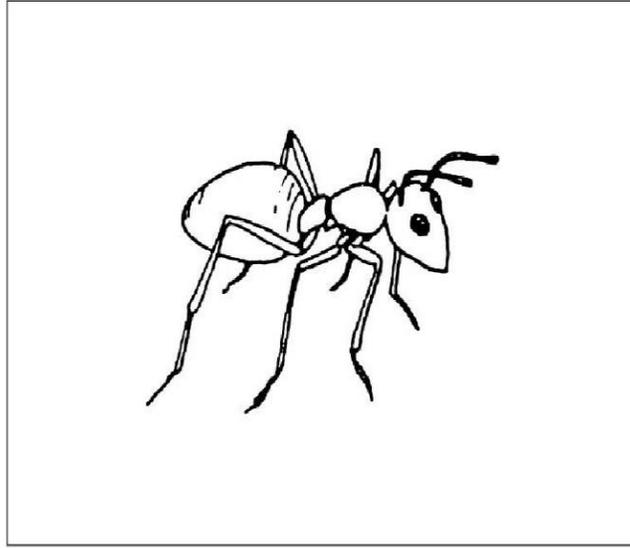


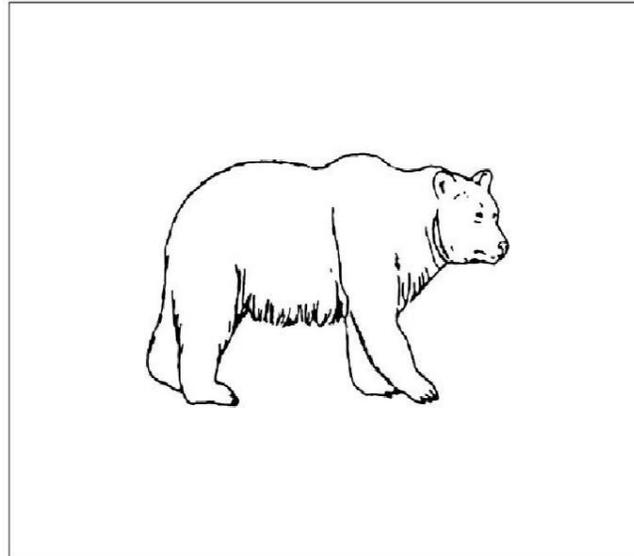
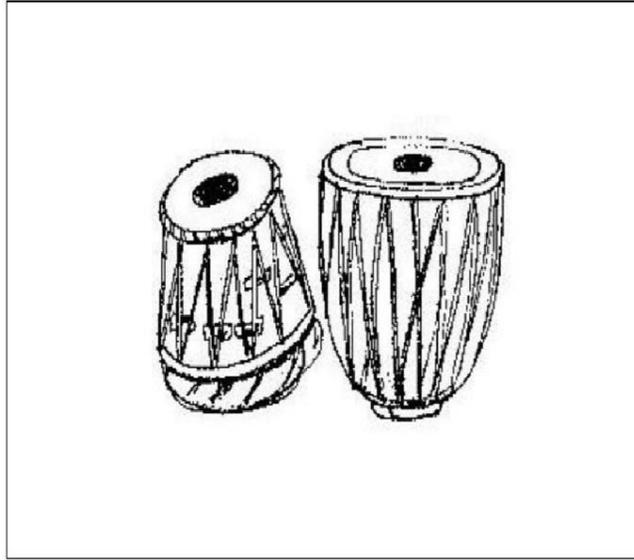


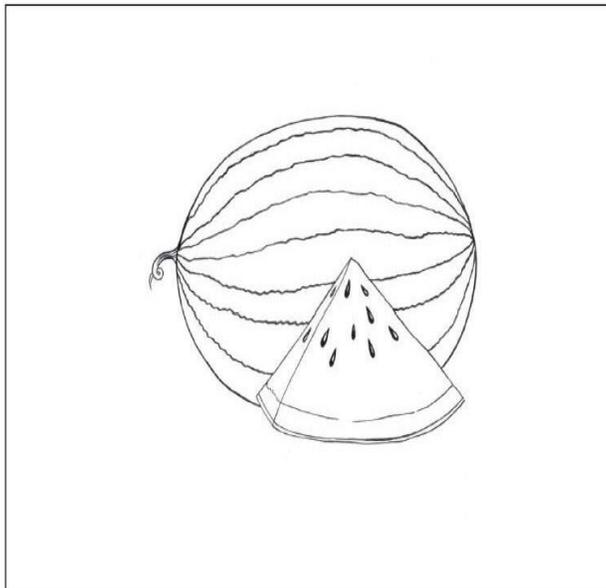
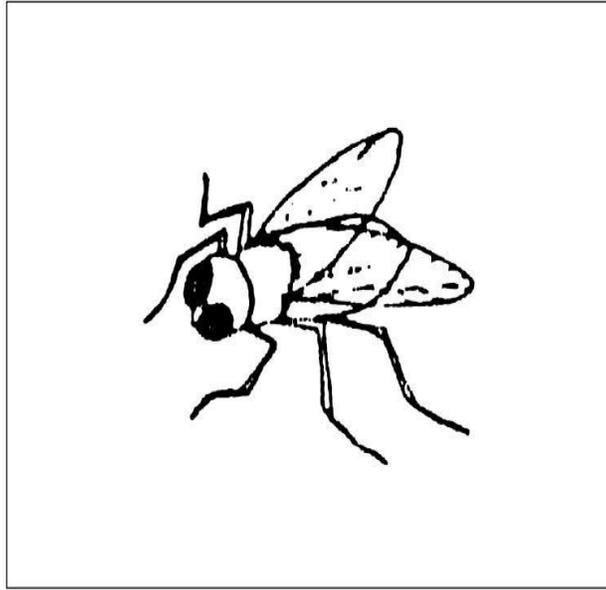


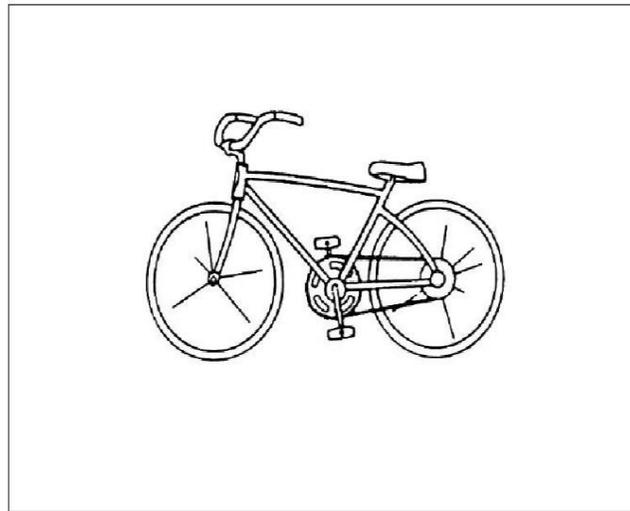


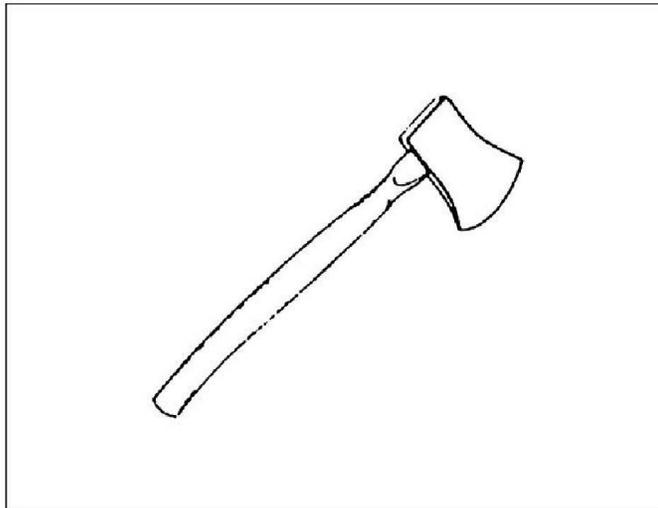
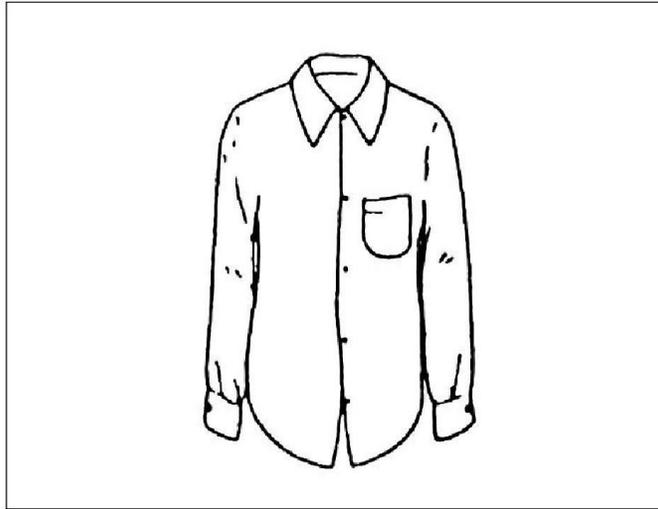


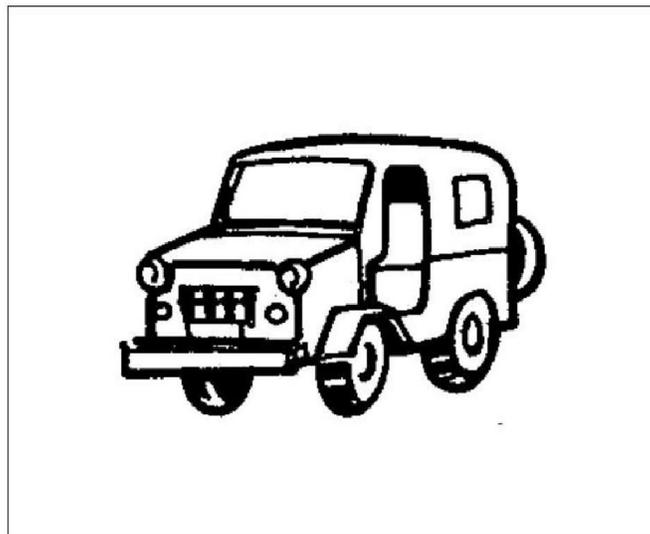
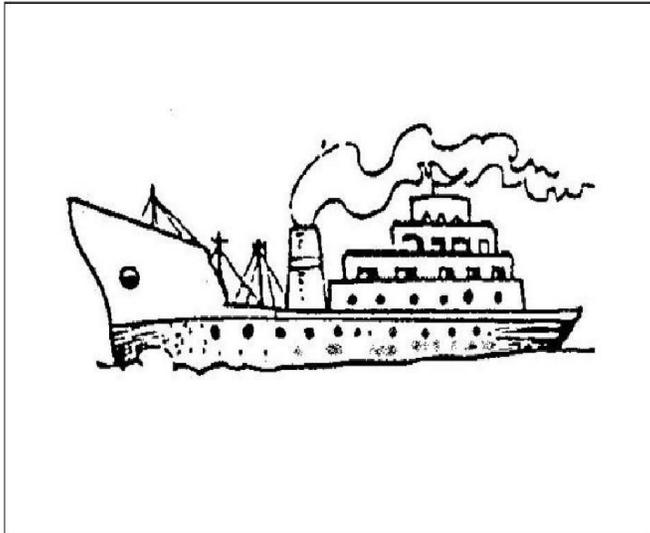


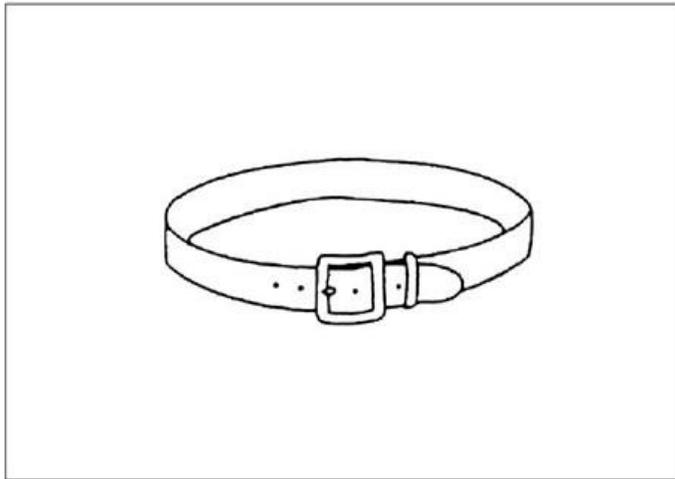
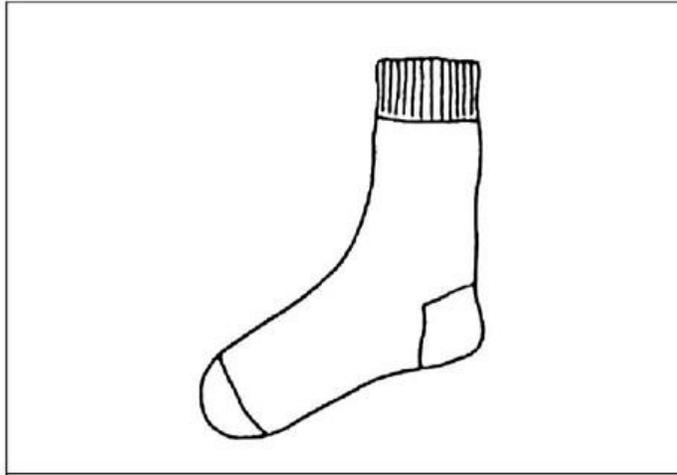


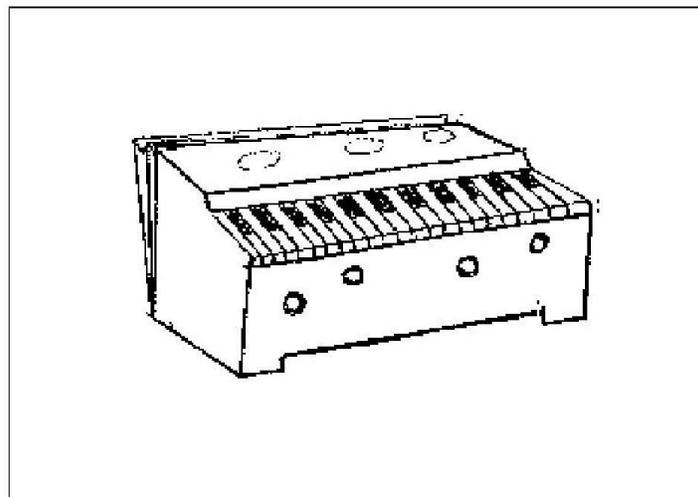
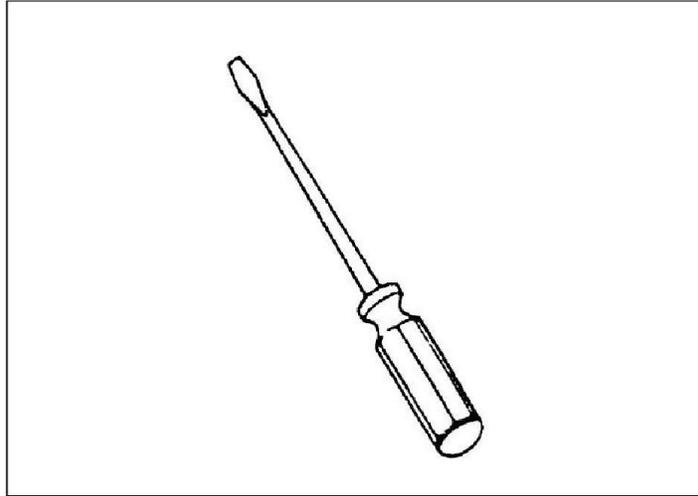


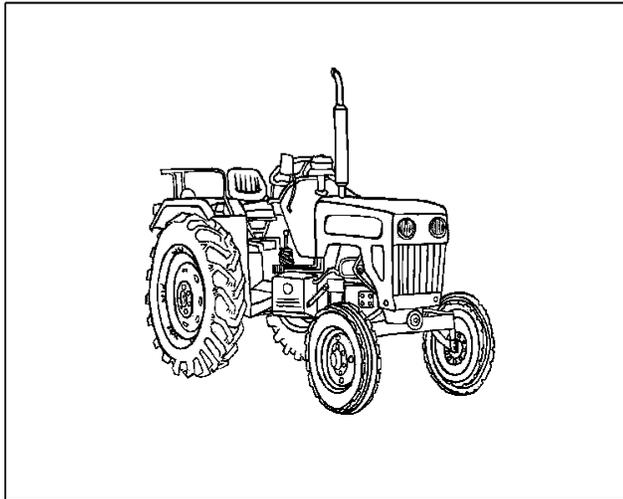
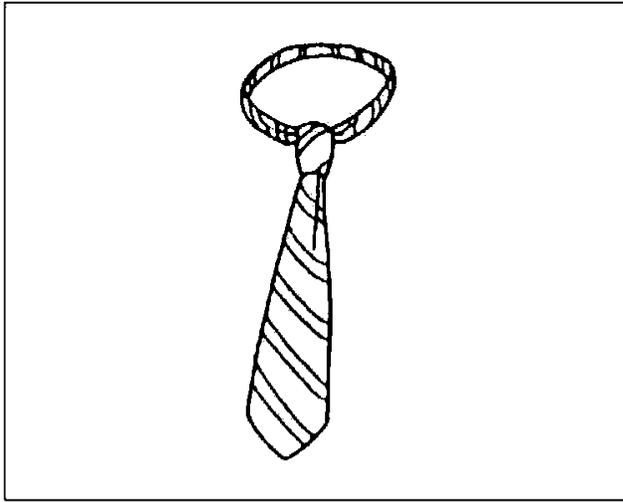












### Appendix A: Semantic and Phonological Cues for Picture Naming Test

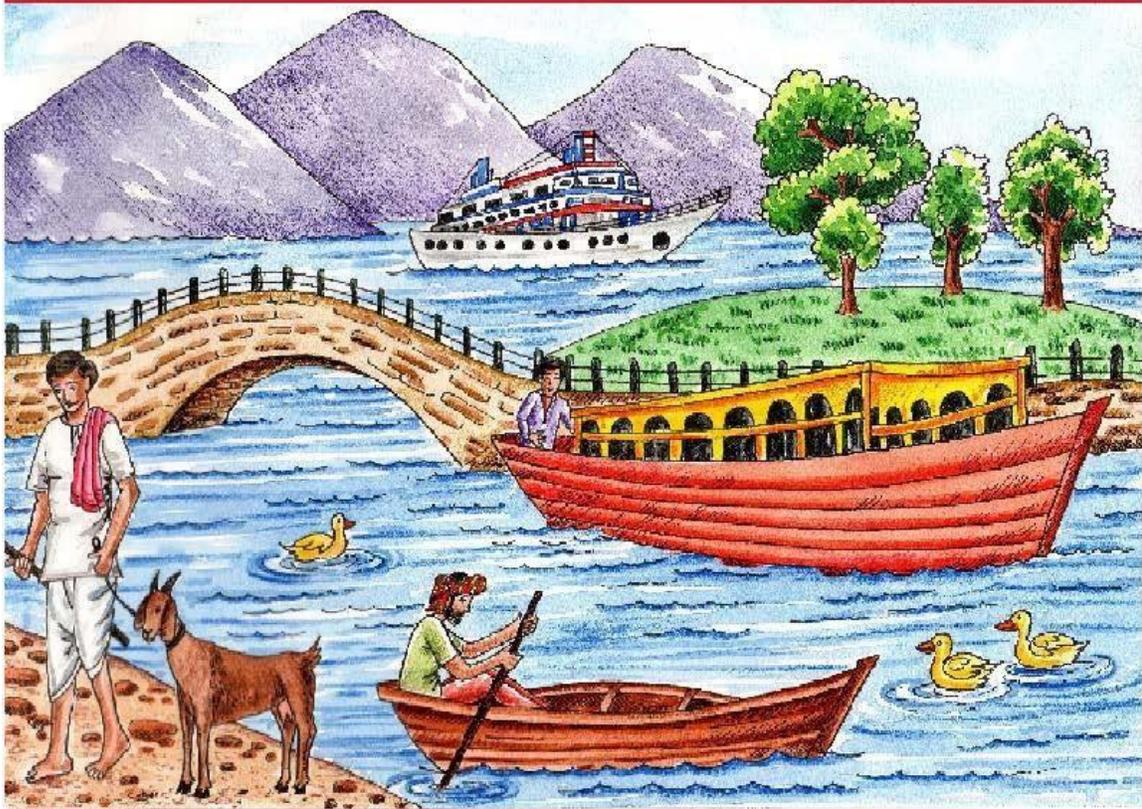
S. No	Stimulus	Below 10 seconds	Semantic cue (this is a /an)	After semantic cue	Phonemic cue (name of the picture begins with)	After phonemic cue
1	Hen		Bird		/h/	
2	Monkey		Animal		/m/	
3	Turtle		Animal		/t/	
4	Pineapple		Fruit		/p/	
5	Brinjal/ Eggplant		Vegetable		/b/(e/)	
6	Eye		Part of the face		/ai/	
7	Butterfly		Insect		/p/	
8	Grapes		Fruit		/g/	
9	Ear		Part of the face		/I/	
10	Eagle		Bird		/i/	
11	Onion		Vegetable		/a/	
12	Pumpkin		Vegetable		/p/	
13	Ant		Insect		/ae/	
14	Carrot		Vegetable		/k/	
15	Tabla		Musical instrument		/t/	
16	Bear		Animal		/b/	
17	Housefly		Insect		/h/	
18	Watermelon		Fruit		/w/	
19	Umbrella		Used when it rains		/a/	
20	Bicycle		Vehicle		/b/	
21	Shirt		Clothing		/Sh/ or /f/	
22	Axe		Tool		/ae/	
23	Ship		Vehicle		/Sh/ or /f/	
24	Jeep		Vehicle		/dz/	
25	Socks		Clothing		/s/	
26	Belt		Accessory		/b/	
27	Screwdriver		Tool		/s/	
28	Harmonium		Musical instrument		/h/	
29	Tie		Clothing		/t/	
30	Tractor		Vehicle		/t/	

Total Correct Response in native language (NL)

Total Correct Response in other language (OL)

Total=NL+OL=
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# Frenchay Aphasia Screening Test



Third Edition  
(Adapted Indian Version)

Pamela Enderby  
Victorine Wood  
Derick Wade

**Stass**  
PUBLICATIONS

## **FRENCHAY APHASIA SCREENING TEST**

The Frenchay's Aphasia Screening Test was developed for use by non-specialists, such as junior medical staff, nurses, occupational therapists and others, to assist in identifying patients who have difficulties understanding, using spoken language, reading or writing. This test is brief and simple to administer, can be used in a busy ward or home situation and has good reliability when used by non-specialists. The test comprises a manual with clear directions, clear picture material, a photocopiable administration form and updated information on the 'Use of the Frenchay's Aphasia Screening Test in Research' written by Professor Pamela Enderby.

### **Indian Adaptation: HINDI APHASIA SCREENING TEST (Dr. Apoorva Pauranik)**

#### **Administration Form**

Materials Required: Picture card with attached reading cards, pencil and papers, stopwatch or watch with seconds hand.

Check: Patient is wearing spectacles (if needed). Patient can hear you adequately (raise voice if necessary). It is recommended that the tests are performed in the given order. Instruction should be given clearly but only once (if instruction requires repetition, score as an error). If a patient cannot be assessed on a subtest, e.g., because of paralysis or visual impairment, mark 'u' for un-assessable.

## **Description of the FAST**

The FAST has been designed to cover the four major aspects of language which may be disturbed in the aphasic patient: comprehension, expression, reading and writing. It has not been designed to test for articulatory disturbances of speech, such as dysarthria, or for speech apraxia which rarely occurs without some degree of aphasia. It has been developed for use with, and tested on, patients seen within days or weeks of an acute stroke.

### **Comprehension**

This is tested using the two drawings on either side of the test card. These drawings were chosen after trials of six designs of differing sizes and complexity. Patients are given instructions, of graded length and linguistic difficulty, to point to various objects, etc. For example, 'point to a boat'; 'before pointing to a duck near the bridge, show me the middle hill'; 'point to the square, the cone and the semicircle'. One point is scored for each fully correct response, giving a total of ten points. Full instructions are given in the administration form.

### **Expression**

The patient is asked to describe the picture. Scoring reflects the complexity of the response. For example, naming only 1-2 objects scores 1, naming 5-7 scores 3. The patient is also asked to name as many animals as he can think of in 60 seconds; the score depends upon the number named, with a maximum score for naming 15.

Again, details are given on the administration form.

### **Reading**

Five written instructions, again of graded difficulty, are provided. They should be shown to the patient in sequential order. One point is given for each correct response. For example, 'show me the bridge'; 'touch the bottom of the card and then the top of it'.

## **Writing**

The patient is asked to write a description of the picture. There is a maximum time of five minutes given for this task but frequently the more able patient, or the patient who is unable to attempt the task, will take much less time. The score depends upon the number of correctly spelled words used, and the level of grammatical construction used.

## **Test abbreviation**

The technical data demonstrates that the presence, or absence, of aphasia can be reliably identified even when the reading and writing subtests are omitted, which shortens the length of time for testing and is more practical in some situations. However, there is evidence that omissions of these items lead to specific dysgraphia or dyslexia being overlooked.

## **Directions for Administration and Interpretation**

Various points should be remembered when using the test. Check that the patient is wearing any necessary hearing aid or spectacles. It is recommended that the tests are performed in the given order. Instruction should be given clearly but only once (if instruction requires repetition, score as an error). If a patient cannot be assessed on a subtest, e.g. because of paralysis or visual impairment, mark 'u' for un-assessable.

**Materials required:**

Picture card with attached reading cards, pencil and paper, stop watch, or watch with second hand.

**Check:**

Patient is wearing spectacles, if needed. Patient can hear you adequately (raise voice if necessary).

**Comprehension**

Show patient card with river scene. Say, 'Look at the picture. Listen carefully to what is said and point to the things I tell you to'. Score 1 for each correctly performed. If instructions require repeating, score as error. Unprompted self-correction may be scored as correct. Score range 0-10.

**Instructions**

*(a) River Scene*

Practice item; 'Point to the river'. Do not score this item. Repeat until patient understands what is required.

- 1.  Point to a boat
- 2.  Point to the tallest tree
- 3.  Point to the man and point to the goat
- 4.  Point to the man's left leg and then to the ship
- 5.  Before pointing to a duck near the bridge, show me the middle hill.

*(b) Shapes*

Practice item; 'Point to the circle'. Repeat until patient understands task.

- 1.  Point to the square
- 2.  Point to the cone
- 3.  Point to the arrow and the square
- 4.  Point to the square, the cone and the semicircle
- 5.  Point to the one that looks like a hill and the one that looks like a half moon

Sub total / 10

**Expression**

(a) Show patient the river scene and say, 'Tell me as much about the picture as you can'. If the patient does not appear to understand, say, 'Name anything you can see in the picture'. Score range 0-5.

**Score**

- 0  Unable to name any objects intelligibly
- 1  Names 1-2 objects
- 2  Names 3-4 objects
- 3  Names 5-7 objects
- 4  Names 8 or 9 objects or uses phrases and sentences, but performance not normal (e.g. hesitations, inappropriate comments, etc.)
- 5  Normal – uses phrases and sentences naming 10 items

(b) Remove picture card from view and inform patient that you are now going to attempt something a little different. Then ask him to name as many animals as he can think of in 1 minute. If patient appears doubtful, explain that you want the names of any kind of animal, wild or domestic, and not just those which many have been seen in the picture. Commence timing as soon as patient names first animal and allow 60 seconds. Score range 0-5

**Score**

- 0  None named
- 1  Names 1-2
- 2  Names 3-5
- 3  Names 6-9
- 4  Names 10-14
- 5  Names 15 or more
- Sub total / 10

**Reading (not to be administered to illiterates)**

Check that the patient is wearing correct spectacles for reading purposes. Show patient river scene and first reading card. Ask them to read the sentence to himself, not aloud, and do whatever it instructs him to do. Proceed in the same manner with the remaining four reading cards. Score range 0-5.

Score 1 for each correct.

- 1.  Point to the goat
- 2.  Show me the bridge
- 3.  Point to the man standing in the barge
- 4.  Touch the left-hand corner of the card
- 5.  Touch the bottom of the card and then the top of it

Sub total / 5

**Writing (not to be administered to illiterates)**

Show patient river scene and say 'Please write as much as you can about what is happening in the picture'. If he does not appear to understand say 'Write anything that you can see in the picture'. If dominant hand is affected ask patient to attempt with non-dominant hand. Encourage, if patient stops prematurely. Allow a MAXIMUM of 5 minutes. Score range 0-5.

**Score**

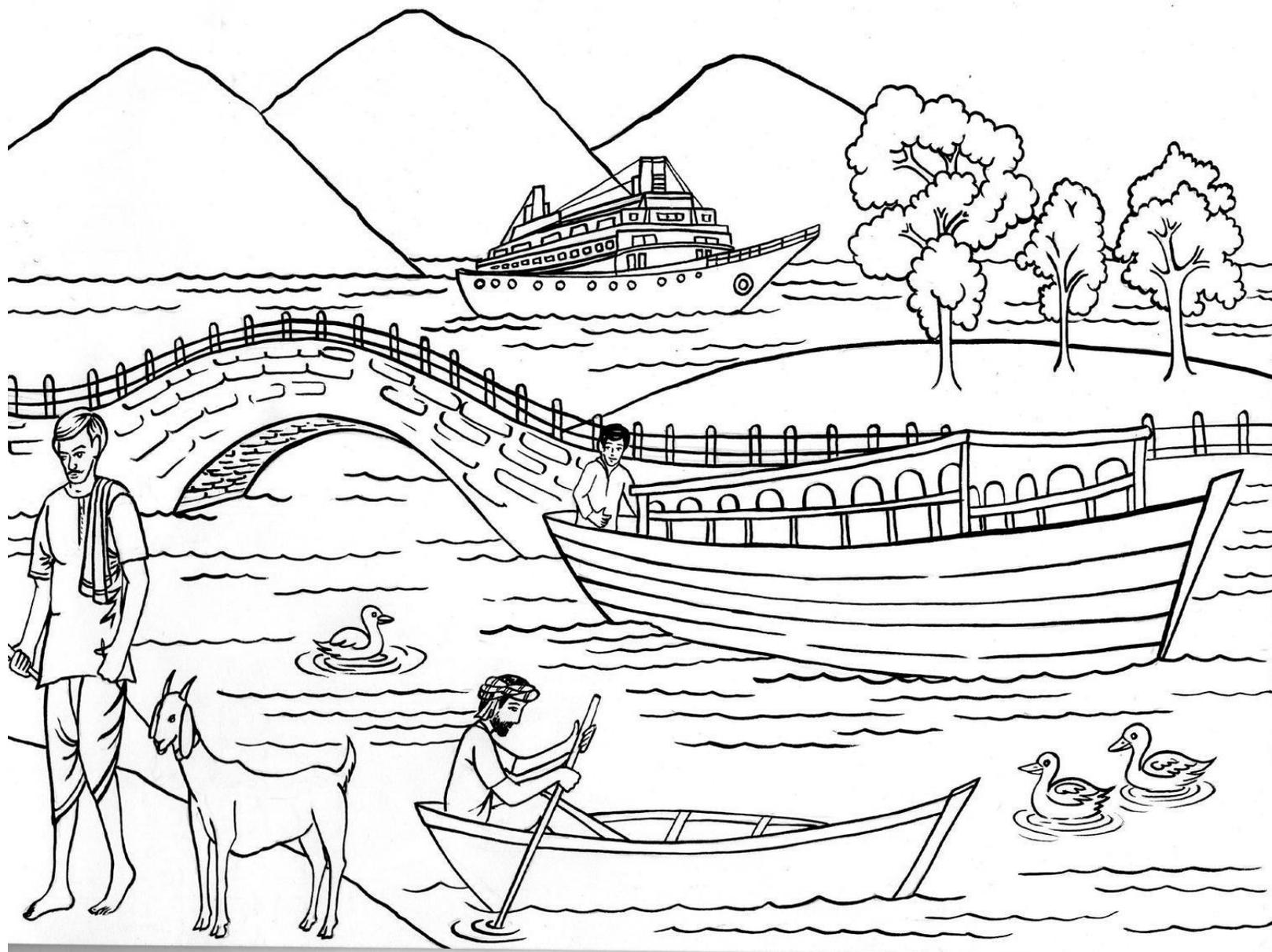
- 0  Able to attempt task but does not write any intelligible or appropriate words
- 1  Writes 1 or 2 appropriate words
- 2  Writes down names of 3 objects or a phrase including 2 or 3 objects
- 3  Writes down names of 4 objects (correctly spelled), or 2 or 3 phrases including names of 4 items
- 4  Uses phrases and sentences, including names of 5 items, but not considered 'normal' performance, e.g. sentence is not integrating people and actions
- 5  Definitely normal performance, e.g. sentence integrating people and actions

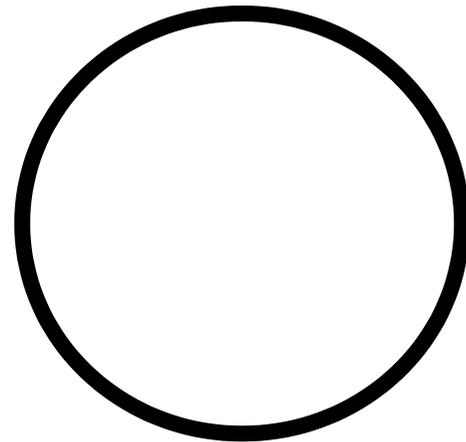
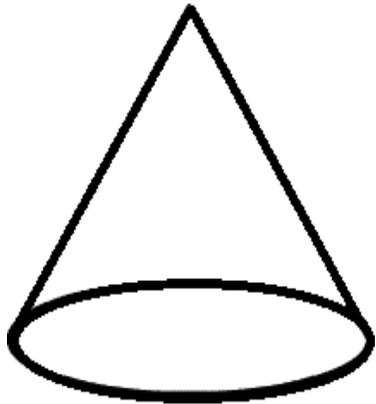
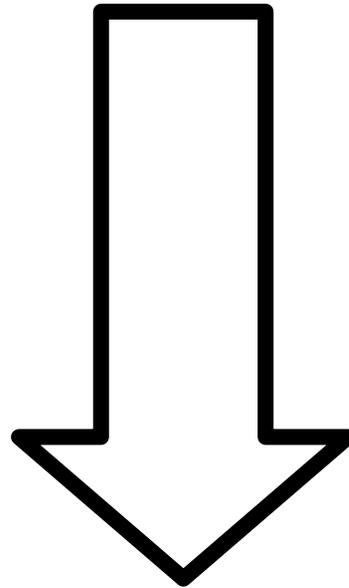
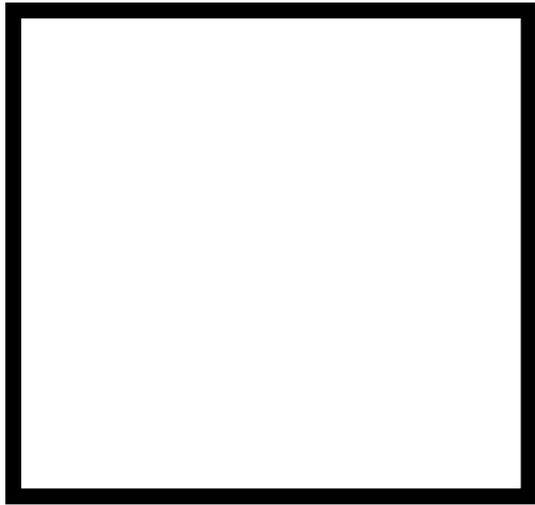
Sub total / 5

**Interpretation**

The presence of aphasia is indicated if the patient scores below the following cut off points. (Referral to speech therapy for full assessment is suggested.)

Enderby, P.M., Wood, V.A., Wade, D.T., & Hewer, R.L. (1986). The Frenchay Aphasia Screening Test: A short, simple test for aphasia appropriate for non-specialists. *International Rehabilitation Medicine*, 8, 166–170. © Elklan Training Ltd 2021.





# 1. Point to the goat

# 2. Show me the bridge

# **3. Point to the man standing in the barge**

# **4. Touch the left hand corner of the card**

# **5. Touch the bottom of the card then the top of it**



# **TESTS OF VISUOSPATIAL FUNCTIONS**

## **MODIFIED TAYLOR COMPLEX FIGURE TEST (MTCF)**

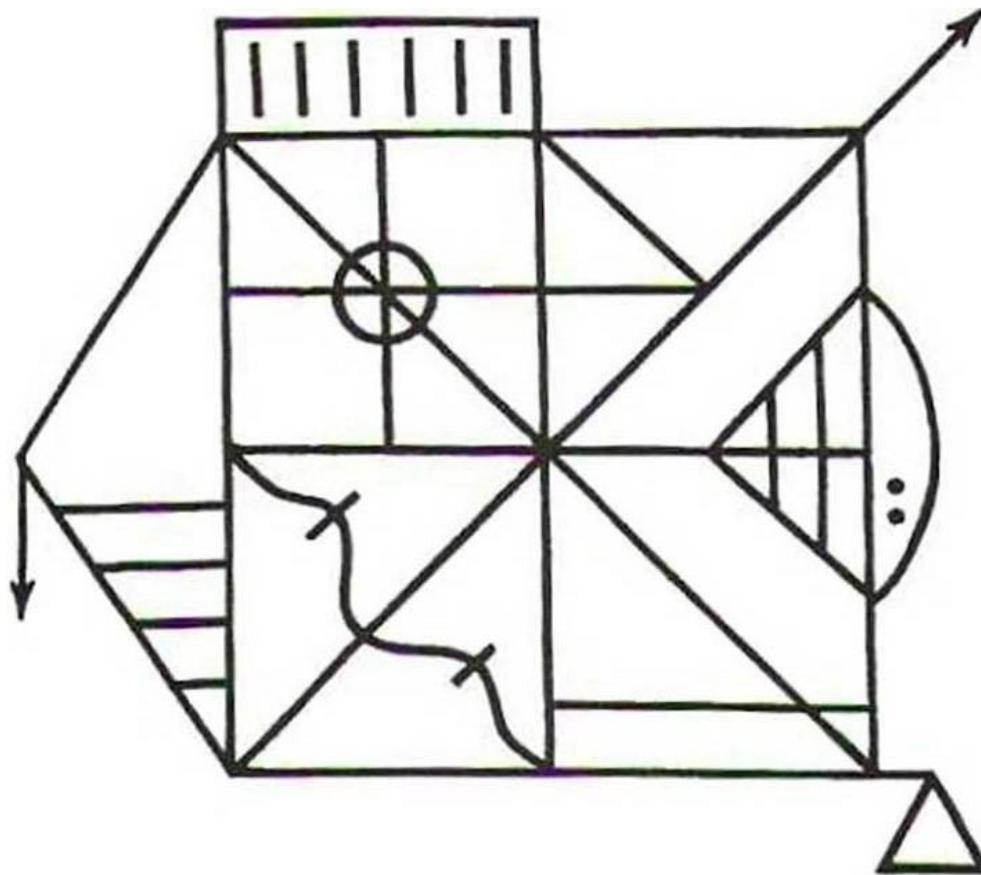
The Modified Taylor Complex Figure (MTCF) Test: This test of visuo-constructive ability was developed by Anita Hubley in 1998. This test consists of a complex design, which is abstract in nature and cannot be named easily. It has an overall structure and multiple sub-components within it. Visual learning and memory is tested with the learning and memory of abstract designs and faces. The MTCF is used to test this ability. The figure from the MTCF is copied first and recalled later. Immediate and delayed recall scores are obtained. Learning over trials is not tested in this test.

### **Instructions to the subject:**

**Copy Task:** *“Please look at the drawing carefully. Now copy the figure on the sheet in front of you.”*

**Immediate Recall Task** (1 min after copy trial): *“Now please try and recall the figure that I showed you earlier and draw it on the paper in front of you.”*

**Delayed Recall Task** (20 min after immediate recall trial): *“Earlier, you were shown a drawing that you copied and later drew from memory. Please draw the figure again on the paper in front of you.”*



### Scoring guidelines for the MTCF

Detail 1:	The large square must look like a square and not be a rectangle. If the square is incomplete or if there are any other distortions (besides it being a rectangle), a score of one-half is given.
Detail 2:	The crossed diagonal lines must touch each of the four corners of the square and must intersect in the middle of the square.
Detail 3:	The horizontal midline of the square must go clearly across from the midpoint of the left side of the square to the midpoint of the right side of the square in one unbroken line.
Detail 4:	The vertical midline must start at the midpoint of the bottom of the square and go through in one unbroken line to the midpoint at the top of the square. In scoring for position for Details 2,3 and 4, these details should intersect at the midpoint of the square. Usually, if they are not, only one is scored as incorrect for position. Very seldom, all three are scored as incorrect for not being in position.
Detail 5:	The short horizontal line in the upper right quadrant of the square must start at the midpoint of the upper half of Detail 4 and stop in the middle of the upper right quadrant (or touch the section of Detail 2 in the quadrant, if present).
Detail 6:	The short diagonal line in the upper right quadrant of the square must start in the upper left corner of that quadrant and stop in the middle of the quadrant (or touch the same section of Detail 2 as described in Detail 5).
Detail 7:	The diagonal arrow extending up from the top right corner of the square should be a continuation of that section of Detail 2. It should not extend more than one- third of the length of the upper right quadrant portion of Detail 2.
Detail 8:	The triangle in the right half of the square should have the right side of the square as its base. The base of the triangle should begin and end in the middle third of the top and bottom halves of the right side of the squares. The apex of the triangle must be in the middle third of the right half of the square. Two vertical lines, dividing the triangle into equal parts and touching both sides of the triangle, must be present.
Detail 9:	The base of the semi-circle should begin and end in the middle third of the top and bottom halves of the right side of the square. Two dots (not circles) lined up vertically within the bottom half of the semi-circle must be present.
Detail 10:	A small equilateral triangle must be attached by its apex to the bottom right corner of the square by a short horizontal line. The triangle must be approximately the same size as Detail 17 with an altitude not more than one-third of the height of the large square and not smaller than one-eighth the height of the small square.
Detail 11:	A horizontal line should extend across the width of the lower third of the lower right quadrant of the square.
Detail 12:	There should be a curved line with a short straight line bisecting each of the two outer peaks of the curve in the lower left quadrant of the square. The curved line should extend completely from the upper left corner to the bottom right corner of the quadrant.
Detail 13:	A large triangle should be attached to the top and bottom points of the left side of the square. The height of the triangle should not be more than half the width of the square. The apex of the triangle should be even with Detail 3.
Detail 14:	There should be four evenly spaced horizontal lines within the bottom half of Detail 13. These lines should touch both sides of the triangle. The top line should not be an extension of Detail 3.
Detail 15:	A vertical arrow should extend down from the apex of Detail 13 and be no shorter than one-quarter, or no longer than one-third, the height of the square.
Detail 16:	A horizontal and a vertical line should bisect the upper left quadrant of the square. These lines should touch each side of the quadrant and intersect at the midpoint of the quadrant.
Detail 17:	There should be a circle in the middle of the upper left quadrant of the square. These lines should touch each side of the quadrant and intersect at the midpoint of the quadrant.
Detail 18:	There should be a rectangle above the top left quadrant of the square. Its left and right sides should be extensions of the left side of the square and of Detail 4 (or the midpoint of the top of the square if Detail 4 is not present). Its height should be less than one-quarter of the height of the square. Six evenly spaced vertical lines should be present and should not touch either the top or bottom sides of the rectangle.

# **MTCF Copy**

# **MTCF Immediate Recall**

# **MTCF Delayed Recall**

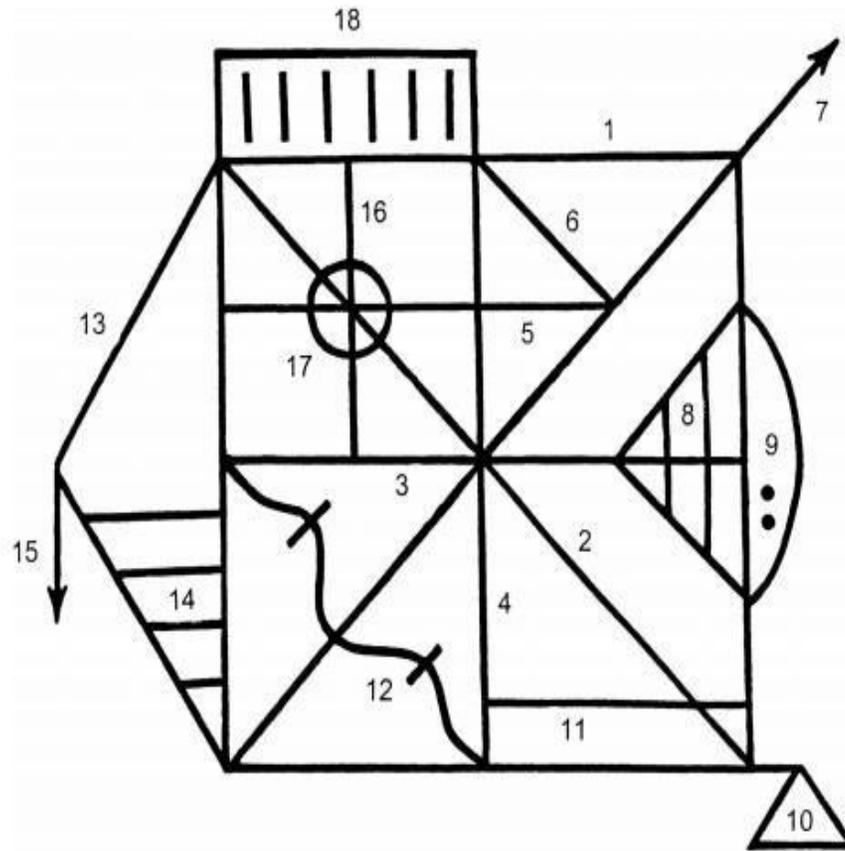


Fig. 2. Modified Taylor Complex Figure (MTCF showing scoring components; © 1996, 1998; A.M. Hubley. Reproduced by permission).

**Scoring System for the Modified Taylor Complex Figure (Intentional) [Hubley, 1998]**

Consider each of the 18 units separately. Appraise the accuracy of each unit and its relative position within the whole of the design. Maximum score is 36 points. For each unit, score as follows:

Correct \_\_\_\_\_ Placed properly \_\_\_\_\_ 2 points  
 Placed poorly \_\_\_\_\_ 1 point

Distorted or incomplete \_\_\_\_\_ Placed properly \_\_\_\_\_ 1 point  
 but recognizable \_\_\_\_\_ Placed poorly \_\_\_\_\_ 1/2 point

Absent or not recognizable \_\_\_\_\_ 0 points

Component	Delay	Copy	IR
1. Large Square			
2. Crossed diagonal lines in 1			
3. Horizontal midline of 1			
4. Vertical midline of 1			
5. Short horizontal line in upper right quadrant			
6. Short diagonal line in the upper right quadrant			
7. Diagonal arrow attached to corner of 1			
8. Triangle in 1 on right, two vertical lines included			
9. Semicircle attached to right side of 1, two dots Included			
10. Triangle attached to 1 by horizontal line			
11. Horizontal line in lower right quadrant			
12. Wavy line, includes two short lines			
13. Large triangle attached to left of 1			
14. Four horizontal lines within 13			
15. Arrow attached to apex of 13			
16. Horizontal and vertical lines in upper left Quadrant			
17. Circle in upper left quadrant			
18. Small rectangle above 1 on left, six lines included			
<b>TOTALS</b>			

# **TESTS OF UNILATERAL SPATIAL NEGLECT**

## LINE BISECTION

The Line Bisection Test is a test is a quick measure to detect the presence of **unilateral spatial neglect (USN)**. To complete the test, one must place a mark with a pencil through the center of a series of horizontal lines. Usually, a displacement of the bisection mark towards the side of the brain lesion is interpreted as a symptom of neglect.

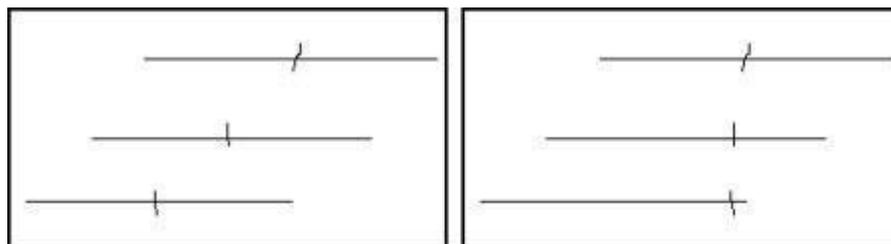
Performance on the Line Bisection Test may be influenced by or may be indicative of other syndromes besides spatial neglect, such as hemianopia (damage of optic pathways that result in loss of vision in half of the visual field) (Ferber & Karnath,2001). Consequently, the Line Bisection Test is not a highly specific measure of USN.

### Administration & Scoring

To complete the test, one must place a mark with a pencil through the center of a series of horizontal lines. Usually, a displacement of the bisection mark towards the side of the brain lesion is interpreted as a symptom of neglect.

**Instructions to the subject:** *“Please place a cross mark/line with the pencil/pen that is provided through the center of each of the lines on the sheet in front of you.”*

In the bisection test, 18 lines were presented on the left, middle, and right of an A4 paper, respectively. The subjects or patients were asked to mark with a pencil a short cross mark (with their preferred or unaffected hand) in the exact middle point or center of the series of 18 horizontal lines on an 11x 8.5-inch page.



A. Normal line bisection

B. Highly impaired line bisection

**Scoring:**

The test is scored by measuring the deviation of the bisection from the true center of the line. A deviation of more than 6 mm from the midpoint indicates USN. Omission of two or more lines on one half of the page indicates USN.

**Duration:**

The test usually takes 5 minutes to complete

[Redacted text block]

[Redacted text block]

# QUESTIONNAIRES

## **GERIATRIC DEPRESSION SCALE (GDS)**

While there are many instruments available to measure depression, the Geriatric Depression Scale (GDS), first created by Yesavage et al., has been tested and used extensively with the older population. It is a brief questionnaire in which participants are asked to respond to the 30 questions by answering yes or no in reference to how they felt on the day of administration. Scores of 0 - 9 are considered normal, 10-19 indicates mild depression and 20-30 indicates severe depression.

**TARGET POPULATION:** The GDS may be used with healthy, medically ill and mild to moderately cognitively impaired older adults. It has been extensively used in community, acute and long-term care settings.

### **Administration & Scoring:**

This test is administered by the clinician and the patient's responses are recorded on the form. It is a forced-choice, yes-no questionnaire.

**Directions to Examiner:** Present questions VERBALLY. Circle answer given by patient. Do not show to patient.

The GDS-30 should be given orally. A clear YES or NO answer is required for each question. If necessary, repeat the question but do not accept a qualified answer from the test-taker.

Cross off either yes or no for each question. Depressive answers (errors) are circled on the form and are bolded below. Count up 1 for each depressive answer (error). The final score is the tally of the number of depressive answers with the following scores indicating depression.

0-9 No depression

10-19 Suggestive of mild depression

20-30 Suggestive of severe depression

What to do if a patient does not answer a few items.

For example, if 3 of 15 items are not answered then the, total score is score on 12 completed PLUS 3/15ths of total score to make-up for omitted items, e.g. if they got a 4 on the 12 they completed or 1/3 positive, add 1/3 of the 3 missing or 1 point for a total of 5.

What if the patient is aphasic?

Use a point-board, or a board with the scale and yes/no next to the items and have patient point out correct answer. If the patient is aphasic due to dementia then other measures should be used to determine the patient's level of depression.

## Geriatric Depression Scale (Long Form)

**Instructions: Choose the best answer for how you felt over the past week.**

No	Question	Answer	Score
1.	Are you basically satisfied with your life?	YES / NO	
2.	Have you dropped many of your activities and interests?	YES / NO	
3.	Do you feel that your life is empty?	YES / NO	
4.	Do you often get bored?	YES / NO	
5.	Are you hopeful about the future?	YES / NO	
6.	Are you bothered by thoughts you can't get out of your head?	YES / NO	
7.	Are you in good spirits most of the time?	YES / NO	
8.	Are you afraid that something bad is going to happen to you?	YES / NO	
9.	Do you feel happy most of the time?	YES / NO	
10.	Do you often feel helpless?	YES / NO	
11.	Do you often get restless and fidgety?	YES / NO	
12.	Do you prefer to stay at home, rather than going out and doing new things?	YES / NO	
13.	Do you frequently worry about the future?	YES / NO	
14.	Do you feel you have more problems with memory than most?	YES / NO	
15.	Do you think it is wonderful to be alive now?	YES / NO	
16.	Do you often feel downhearted and blue?	YES / NO	
17.	Do you feel pretty worthless the way you are now?	YES / NO	
18.	Do you worry a lot about the past?	YES / NO	
19.	Do you find life very exciting?	YES / NO	
20.	Is it hard for you to get started on new projects?	YES / NO	
21.	Do you feel full of energy?	YES / NO	
22.	Do you feel that your situation is hopeless?	YES / NO	
23.	Do you think that most people are better off than you are?	YES / NO	
24.	Do you frequently get upset over little things?	YES / NO	
25.	Do you frequently feel like crying?	YES / NO	
26.	Do you have trouble concentrating?	YES / NO	
27.	Do you enjoy getting up in the morning?	YES / NO	
28.	Do you prefer to avoid social gatherings?	YES / NO	
29.	Is it easy for you to make decisions?	YES / NO	
30.	Is your mind as clear as it used to be?	YES / NO	
<b>TOTAL</b>			

This is the original scoring for the scale: One point for each of these answers.  
Cutoff: normal-0-9; mild depressives-10-19; severe depressives-20-30.

1. NO	6. YES	11. YES	16. YES	21. NO	26. YES
2. YES	7. NO	12. YES	17. YES	22. YES	27. NO
3. YES	8. YES	13. YES	18. YES	23. YES	28. YES
4. YES	9. NO	14. YES	19. NO	24. YES	29. NO
5. NO	10. YES	15. NO	20. YES	25. YES	30. NO

Yesavage, J.A., Brink, T.L., Rose, T.L., Lum, O., Huang, V., Adey, M., & Leirer, V.O. (1982). Development and validation of a geriatric depression screening scale: A preliminary report. *Journal of Psychiatric Research*, 17, 37-49. © Yesavage, J.A.

**SCALE FOR THE INSTRUMENTAL ACTIVITIES OF DAILY LIVING IN  
THE ELDERLY (IADL-EDR)**

The assessment of functional status is critical when caring for older adults. Normal changes due to aging, acute illness, worsening chronic illness, and hospitalization can contribute to a decline in the ability to perform tasks necessary to live independently in the community. The information from a functional assessment can provide objective data to assist with targeting individualized rehabilitation needs or to plan for specific in home services such as meal preparation, nursing and personal care, home-maker services, financial and medication management, and/or continuous supervision. A functional assessment can also guide the clinician to focus on the person's baseline capabilities, facilitating early recognition of changes that may signify a need either for additional resources or for a medical work-up (Greenberg & McCabe, 2018).

**INSTRUCTIONS:** *Read aloud to the subject each of the 11 items and the response that follow. Ask them to circle "Yes" if they consider it as applicable to them (or their patient) and circle "No", if otherwise. If they circle "Yes", ask them to choose from one of the three responses that follow, the one they consider most applicable to them (or their patient). If they choose the second or third response for any of the items, ask them to circle the score against that response under the column "CD", if they consider that disability to be resulting from cognitive impairment or circle the score under "PD", if it considered to be resulting from physical impairment. If they think that both the impairments are contributory, then ask them to circle the scores in both the columns. If they think that both the impairments are contributory, but to different extents, then they may circle the appropriate score in each of the column (e.g., circle 1 for CD and 2 for PD). If the subject chooses the second or third response for any activity, ensure that they (or their patient) were capable of doing the activity at some point of time in the past. An item may be rated as not applicable if that task was not done by the subject any time in the past for either want of necessity (e.g., banking is done by the husband) or opportunity (e.g., is an atheist, does not pray). If a task was being done by the subject in the past but is not done now because other members of the family do it, then it must not be rated as "not applicable". In such a case, it should be clarified if the subject is now competent to do it on his/her own, and rated accordingly.*

Name: \_\_\_\_\_ Testing Date: \_\_\_\_\_

DOB (Age): \_\_\_\_\_ Gender: \_\_\_\_\_

Urban/Rural: \_\_\_\_\_ Education (yrs.): \_\_\_\_\_

Informant: \_\_\_\_\_ Relationship: \_\_\_\_\_

	Applicable		CD	PD
	No	Yes		
1. Ability to use telephone				
0. Operates telephone on own initiative (looks up and dials numbers etc.)			0	0
1. Answers phone but asks help for dialing			1	1
2. Unable to use telephone			2	2
2. Shopping	No	Yes		
0. Takes care of all shopping needs independently			0	0
1. Shops independently only for small purchases.			1	1
2. Unable to shop.			2	2
3. Meal preparation	No	Yes		
0. Plans, prepares and serves adequate and well cooked meals independently.			0	0
1. Prepares inadequate meals or can only heat and serve prepared meal.			1	1
2. Unable to either prepare or serve meals.			2	2
4. Housekeeping	No	Yes		
0. Maintains house alone or with occasional assistance (e.g., heavy work-domestic help).			0	0

	1. Performs light daily tasks such as dishwashing, bed-making etc.			1	1
	2. Unable to do housekeeping.			2	2
5.	Travel	No	Yes		
	0. Travels independently (public or private transport)			0	0
	1. Travels independently only to selected or well practised destinations.			1	1
	2. Needs to be accompanied for travel purposes on public transport.			2	2
6.	Manage finance	No	Yes		
	0. Independently manages personal finance (pay bills, banking, lending or borrowing, budget).			0	0
	1. Manages only day-to-day purchases, but unable to handle large sums of money.			1	1
	2. Unable to handle any finances.			2	2
7.	Social activity/ interactions	No	Yes		
	0. Spontaneously interacts unassisted and normally with both strangers as well as acquaintances.			0	0
	1. Spontaneously interacts unassisted and normally with <u>close</u> family members and friends only.			1	1
	2. No spontaneous interactions.			2	2
8.	Personal care	No	Yes		
	0. Takes proper and complete personal care (face-washing, brushing, toilet, bathing, grooming, dressing).			0	0
	1. Independent for simple activities (face-washing, brushing) only or needs reminder for personal care.			1	1
	2. Shows no interest in personal care.			2	2
9.	Entertainment and information	No	Yes		

0. Does at least one of the activity (reading, watching TV, listening to radio, conversing) independently and meaningfully.			0	0
1. Performs the activity but often needs help in comprehending it.			1	1
2. Unable to perform the activity or comprehend it.			2	2
10. Shaving (beard or moustache)	No	Yes		
0. Fully independent			0	0
1. Can soap but needs helps with the razor.			1	1
2. Unable to shave on his own.			2	2
11. Prayer activity	No	Yes		
0. Able to participate in all prayer related activities (verbal and ritual).			0	0
1. Needs prompting or correction with verbal or ritual related elements of prayer.			1	1
2. Unable to participate in prayer activities.			2	2

---

Number of Applicable Items  
 (NAI) = Total Cognitive Disability  
 Score (CDS) = Total Physical  
 Disability Score (PDS) =


**Calculating the Cognitive Disability Index (CDI) and the Physical Disability Index (PDI):**

Add up and enter in the space provided above, the number of applicable questions (NAI), and the circled scores in the columns CD (CDS) and PD (PDS).

The CDI or PDI can be calculated provided the NAI is 6 or more. Use the following formula to calculate the CDI and/or PDI. Alternatively, read it from the table overleaf.

$$\text{CDI} = \text{CDS} / 2 \times \text{NAI}$$

$$\text{PDI} = \text{PDS} / 2 \times \text{NAI}$$

**Table for calculating the Cognitive Disability Index (CDI) and Physical Disability Index (PDI) on IADL-EDR**

To know the CDI or PDI, read the CDS (Cognitive Disability Score) or PDS (Physical Disability Score) obtained against the NAI (Number of Applicable Items) on the IADL-EDR (e.g., if the CDS is 5 and the NAI is 9 then the CDI is 27.8).

CDS	NAI					
	6	7	8	9	10	11
0	0.0	0.0	0.0	0.0	0.0	0.0
1	8.3	7.1	6.3	5.6	5.0	4.5
2	16.7	14.3	12.5	11.1	10.0	9.1
3	25.0	21.4	18.8	16.7	15.0	13.6
4	33.3	28.6	25.0	22.2	20.0	18.2
5	41.7	35.7	31.3	27.8	25.0	22.7
6	50.0	42.8	37.5	33.3	30.0	27.2
7	58.3	50.0	43.8	38.9	35.0	31.8
8	66.6	57.1	50.0	44.4	40.0	36.3
9	75.0	64.3	56.3	50.0	45.0	40.9
10	83.3	71.4	62.5	55.5	50.0	45.4
11	91.6	78.5	68.8	61.1	55.0	49.9
12	100.0	85.7	75.0	66.6	60.0	54.5
13		92.8	81.3	72.2	65.0	59.0
14		100.0	87.5	77.7	70.0	63.6
15			93.8	83.3	75.0	68.1
16			100.0	88.8	80.0	72.6
17				94.4	85.0	77.2
18				99.9	90.0	81.7
19					95.0	86.3
20					100.0	90.8
21						95.3
22						99.9

Mathuranath P S et. al. Instrumental Activities Of Daily Living Scale For Dementia Screening in the elderly. International Psychogeriatrics 2005; 17(3):461-474 © Mathuranath P. S.

## **Neuropsychiatric Inventory (NPI): (NPI-Brief)**

NPI is a brief retrospective caregiver/informant-based interview covering 12 NPS, including delusions, hallucinations, agitation/aggression, dysphoria/depression, anxiety, euphoria/elation, apathy/indifference, disinhibition, irritability/lability, aberrant motor behaviors, night-time behavioral disturbances and appetite/eating disturbances. It is a caregiver-based questionnaire in which the caregiver indicates the presence or absence of NPS in the patient during the last few weeks. It can be completed in 5 to 10 minutes.

<b>Behaviors</b>	<b>S</b>	<b>D</b>
Delusions		
Hallucinations		
Agitation		
Depression		
Anxiety		
Euphoria		
Apathy		
Disinhibition		
Irritability		
Aberrant motor behavior		
Night-time behaviors		
Appetite and eating disorders		
<b>Total</b>		

Cummings, J.L., Mega, M., Gray, K., Rosenberg-Thompson, S., Carusi, D.A., & Gornbein, J. (1994). The Neuropsychiatric Inventory: Comprehensive assessment of psychopathology in dementia. *Neurology*, 44, 2308–2314. © Cummings, J.L.

**Severity** is rated as:

1. Mild- produce little distress in the patient
2. Moderate- more disturbing to the patient but can be redirected by the caregiver
3. Severe- very disturbing to the patient and difficult to redirect.

**Distress** is rated as

0-No distress

1- Minimal

2- Mild

3- Moderate

4- Severe

5- Very severe or extreme

## **Informant Questionnaire on Cognitive Decline in the Elderly (IICODE)**

The Informant Questionnaire for Cognitive Decline in the Elderly (IICODE) is a structured interview based on informant responses that is used to assess for possible dementia. IICODE has been used for retrospective assessment of cognitive decline.

### **Instructions**

*Now we want you to remember what your friend or relative was like 10 years ago and to compare it with what he/she is like now. Below are situations where this person has to use his/her memory or intelligence and we want you to indicate whether this has improved, stayed the same, or got worse in that situation over the past 10 years. Note the importance of comparing his/her present performance with 10 years ago. So, if 10 years ago this person always forgot where he/she had left things, and he/she still does, then this would be considered 'Hasn't changed much'. Please indicate the changes you have observed by circling the appropriate answer. Compared with 10 years ago how is this person at:*

1. Recognizing the faces of family and friends
  - 1) Much improved
  - 2) A bit improved
  - 3) Not much change
  - 4) A bit worse
  - 5) Much worse
  
2. Remembering the names of family and friends
  - 1) Much improved
  - 2) A bit improved
  - 3) Not much change
  - 4) A bit worse
  - 5) Much worse

3. Remembering things about family and friends e.g. occupations, birthdays, addresses

- 1) Much improved
- 2) A bit improved
- 3) Not much change
- 4) A bit worse
- 5) Much worse

4. Remembering things that have happened recently

- 1) Much improved
- 2) A bit improved
- 3) Not much change
- 4) A bit worse
- 5) Much worse

5. Recalling conversations a few days later

- 1) Much improved
- 2) A bit improved
- 3) Not much change
- 4) A bit worse
- 5) Much worse

6. Forgetting what he/she wanted to say in the middle of a conversation

- 1) Much improved
- 2) A bit improved
- 3) Not much change
- 4) A bit worse
- 5) Much worse

7. Remembering his/her address and telephone number

- 1) Much improved
- 2) A bit improved
- 3) Not much change
- 4) A bit worse
- 5) Much worse

8. Remembering what day and month it is

- 1) Much improved
- 2) A bit improved
- 3) Not much change
- 4) A bit worse
- 5) Much worse

9. Remembering where things are usually kept

- 1) Much improved
- 2) A bit improved
- 3) Not much change
- 4) A bit worse
- 5) Much worse

10. Remembering where to find things, which have been put in a different place from usual

- 1) Much improved
- 2) A bit improved
- 3) Not much change
- 4) A bit worse
- 5) Much worse

11. Adjusting to any change in his/her day-to-day routine

- 1) Much improved
- 2) A bit improved
- 3) Not much change
- 4) A bit worse
- 5) Much worse

12. Knowing how to work familiar machines in and around the house

- 1) Much improved
- 2) A bit improved
- 3) Not much change
- 4) A bit worse

5) Much worse

13. Learning to use a new gadget or machine in and around the house

1) Much improved

2) A bit improved

3) Not much change

4) A bit worse

5) Much worse

14. Learning new things in general

1) Much improved

2) A bit improved

3) Not much change

4) A bit worse

5) Much worse

15. Remembering things that happened to him/her when he/she was young

1) Much improved

2) A bit improved

3) Not much change

4) A bit worse

5) Much worse

16. Remembering things he/she learned when he/she was young

1) Much improved

2) A bit improved

3) Not much change

4) A bit worse

5) Much worse

17. Understanding the meaning of unusual words

1) Much improved

2) A bit improved

3) Not much change

- 4) A bit worse
- 5) Much worse

18. Understanding magazine or newspaper articles

- 1) Much improved
- 2) A bit improved
- 3) Not much change
- 4) A bit worse
- 5) Much worse

19. Following a story in a book or on TV, radio, or magazine

- 1) Much improved
- 2) A bit improved
- 3) Not much change
- 4) A bit worse
- 5) Much worse

20. Composing a letter to friends or for business purposes

- 1) Much improved
- 2) A bit improved
- 3) Not much change
- 4) A bit worse
- 5) Much worse

21. Knowing about important historical events of the past

- 1) Much improved
- 2) A bit improved
- 3) Not much change
- 4) A bit worse
- 5) Much worse

22. Making decisions on everyday matters

- 1) Much improved
- 2) A bit improved

- 3) Not much change
- 4) A bit worse
- 5) Much worse

23. Handling money for shopping

- 1) Much improved
- 2) A bit improved
- 3) Not much change
- 4) A bit worse
- 5) Much worse

24. Handling financial matters, e.g. the pension, dealing with the bank, planning a monthly domestic budget

- 1) Much improved
- 2) A bit improved
- 3) Not much change
- 4) A bit worse
- 5) Much worse

25. Handling other everyday arithmetic problems, e.g. knowing how much food to buy, knowing how long between visits from family or friends

- 1) Much improved
- 2) A bit improved
- 3) Not much change
- 4) A bit worse
- 5) Much worse

26. Using his/her intelligence to understand what's going on and to reason things through

- 1) Much improved
- 2) A bit improved
- 3) Not much change
- 4) A bit worse
- 5) Much worse

**Scoring:**

Total score out of 26 = obtained score/26

**Interpretation**

Each item is rated on a one to five scale: much improved (1), bit improved (2), not much change (3), a bit worse (4), much worse (5). You have to select the appropriate rating to record the response.

Average score of >3.27 means Dementia

Jorm, A. & Korten, A. (1988). Assessment of cognitive decline in the elderly by informant interview. *The British Journal of Psychiatry*, 152, 209–213. © Jorm, A. & Korten, A L.

**QUALITY OF LIFE SCALE SF-36 (RAND)**  
**QUESTIONNAIRE**

Quality of life (QOL) measures have become a vital and often required part of health outcomes appraisal. For populations with chronic disease, measurement of QOL provides a meaningful way to determine the impact of health care.

**Instructions for completing the questionnaire:** *“Please answer every question. Some questions may look like others, but each one is different. Please take the time to read and answer each question carefully by ticking the option that best represents your response.”*

Patient Name: \_\_\_\_\_ SSN#: \_\_\_\_\_

Person helping to complete this form: \_\_\_\_\_ Date: \_\_\_\_\_

**1. In general, would you say your health is:**

- Excellent
- Very good
- Good
- Fair
- Poor

**2. Compared to one year ago, how would you rate your health in general now?**

- Much better now than a year ago
- Somewhat better now than a year ago
- About the same as one year ago
- Somewhat worse now than one year ago
- Much worse now than one year ago

**The following items are about activities you might do during a typical day. Does your health now limit you in these activities? If so, how much?**

**3. Vigorous activities, such as running, lifting heavy objects, participating in strenuous sports.**

- Yes, limited a lot.
- Yes, limited a little.
- No, not limited at all.

**4. Moderate activities, such as moving a table, pushing a vacuum cleaner, bowling, or playing golf?**

- Yes, limited a lot.
- Yes, limited a little.
- No, not limited at all.

**5. Lifting or carrying groceries.**

- Yes, limited a lot.
- Yes, limited a little.
- No, not limited at all

**6. Climbing several flights of stairs.**

- Yes, limited a lot.
- Yes, limited a little.
- No, not limited at all.

**7. Climbing one flight of stairs.**

- Yes, limited a lot.
- Yes, limited a little.
- No, not limited at all.

**8. Bending, kneeling or stooping.**

- Yes, limited a lot.
- Yes, limited a little.
- No, not limited at all.

**9. Walking more than one mile.**

- Yes, limited a lot.
- Yes, limited a little.
- No, not limited at all.

**10. Walking several blocks.**

- Yes, limited a lot.
- Yes, limited a little.
- No, not limited at all.

**11. Walking one block.**

- Yes, limited a lot.
- Yes, limited a little.
- No, not limited at all.

**12. Bathing or dressing yourself.**

- Yes, limited a lot.
- Yes, limited a little.
- No, not limited at all.

**During the past 4 weeks, have you had any of the following problems with your work or other regular daily activities as a result of your physical health?**

**13. Cut down the amount of time you spent on work or other activities?**

- Yes
- No

**14. Accomplished less than you would like?**

- Yes
- No

**15. Were limited in the kind of work or other activities?**

- Yes
- No

**16. Had difficulty performing the work or other activities (for example, it took extra time)?**

- Yes
- No

**During the past 4 weeks, have you had any of the following problems with your work or other regular daily activities as a result of any emotional problems (such as feeling depressed or anxious)?**

**17. Cut down the amount of time you spent on work or other activities?**

- Yes
- No

**18. Accomplished less than you would like?**

- Yes
- No

**19. Didn't do work or other activities as carefully as usual?**

- Yes

- No

**20. During the past 4 weeks, to what extent has your physical health or emotional problems interfered with your normal social activities with family, friends, neighbors, or groups?**

- Not at all
- Slightly
- Moderately
- Quite a bit
- Extremely

**21. How much bodily pain have you had during the past 4 weeks?**

- None
- Very mild
- Mild
- Moderate
- Severe
- Very severe

**22. During the past 4 weeks, how much did pain interfere with your normal work (including both work outside the home and housework)?**

- Not at all
- Slightly
- Moderately
- Quite a bit
- Extremely

**These questions are about how you feel and how things have been with you during the past 4 weeks. For each question, please give the one answer that comes closest to the way you have been feeling. How much of the time during the past 4 weeks?**

**23. Did you feel full of pep?**

- All of the time
- Most of the time
- A good bit of the time
- Some of the time
- A little of the time
- None of the time

**24. Have you been a very nervous person?**

- All of the time
- Most of the time
- A good bit of the time
- Some of the time
- A little of the time
- None of the time

**25. Have you felt so down in the dumps nothing could cheer you up?**

- All of the time
- Most of the time
- A good bit of the time
- Some of the time
- A little of the time
- None of the time

**26. Have you felt calm and peaceful?**

- All of the time
- Most of the time
- A good bit of the time
- Some of the time
- A little of the time
- None of the time

**27. Did you have a lot of energy?**

- All of the time
- Most of the time
- A good bit of the time
- Some of the time
- A little of the time
- None of the time

**28. Have you felt downhearted and blue?**

- All of the time
- Most of the time
- A good bit of the time

- Some of the time
- A little of the time
- None of the time

**29. Did you feel worn out?**

- All of the time
- Most of the time
- A good bit of the time
- Some of the time
- A little of the time
- None of the time

**30. Have you been a happy person?**

- All of the time
- Most of the time
- A good bit of the time
- Some of the time
- A little of the time
- None of the time

**31. Did you feel tired?**

- All of the time
- Most of the time
- A good bit of the time
- Some of the time
- A little of the time
- None of the time

**32. During the past 4 weeks, how much of the time has your physical health or emotional problems interfered with your social activities (like visiting friends, relatives, etc.)?**

- All of the time
- Most of the time
- Some of the time
- A little of the time
- None of the time

Ware, J., Snow, K., Kosinski, M., & Gendek, B. (1993). RAND 36- Item Health Survey: Manual and Interpretation Guide. Boston, MA: The Health Institute, The New England Medical Center. © Ware, J.

**Scoring:**

**Table 1**

**Step 1: Recoding Items**

<b>Item numbers</b>	<b>Change original response category *</b>	<b>To recoded value of:</b>
1, 2, 20, 22, 34, 36	1 →	100
	2 →	75
	3 →	50
	4 →	25
	5 →	0
3, 4, 5, 6, 7, 8, 9, 10, 11, 12	1 →	0
	2 →	50
	3 →	100
13, 14, 15, 16, 17, 18, 19	1 →	0
	2 →	100
21, 23, 26, 27, 30	1 →	100
	2 →	80
	3 →	60
	4 →	40
	5 →	20
	6 →	0
24, 25, 28, 29, 31	1 →	0
	2 →	20
	3 →	40
	4 →	60
	5 →	80
	6 →	100
32, 33, 35	1 →	0
	2 →	25
	3 →	50
	4 →	75
	5 →	100

**Table 2****Step 2: Averaging Items to Form Scales**

Scale	Number of items	After recoding per Table 1, average the following items
Physical functioning	10	3 4 5 6 7 8 9 10 11 12
Role limitations due to physical health	4	13 14 15 16
Role limitations due to emotional problems	3	17 18 19
Energy/fatigue	4	23 27 29 31
Emotional well- being	5	24 25 26 28 30
Social functioning	2	20 32
Pain	2	21 22
General health	5	1 33 34 35 36

**Table 3: Reliability, Central Tendency, and Variability of Scales in the Medical Outcomes Study**

Scale	Items	Alpha	Mean	SD
Physical functioning	10	0.93	70.61	27.42
Role functioning/physical	4	0.84	52.97	40.78
Role functioning/emotional	3	0.83	65.78	40.71
Energy/fatigue	4	0.86	52.15	22.39
Emotional well-being	5	0.90	70.38	21.97
Social functioning	2	0.85	78.77	25.43
Pain	2	0.78	70.77	25.46
General health	5	0.78	56.99	21.11
Health change	1	—	59.14	23.12

Ware, J.E., Jr., & Sherbourne, C.D. "The MOS 36-Item Short-Form Health Survey (SF-36): I. Conceptual Framework and Item Selection,," *Medical Care*, 30:473-483, 1992.